Workshop Manual

Jetta 2005 ➤
Bora 2006 ➤
Golf Variant 2007 ➤

4-cylinder diesel engine with unit injector									
Engine ID	BKC	BLS	BRM	BXE					

Edition 05.2007

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents

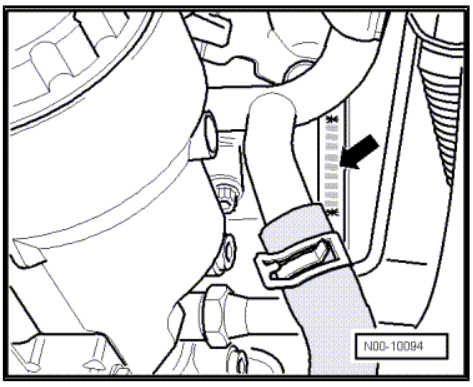
00 – Technical data

1 Technical data

Engine number ⇒ page 1

Engine data ⇒ page 1

1.1 Engine number



The engine number (“Engine code” and “Serial number”) can be found on the join between engine and gearbox -arrow-.

The engine number consists of up to nine characters (alphanumeric). The first part (up to 3 code letters) represents the “engine code letters”, the second part (6 digits) the “serial number”. If more than 999,999 engines were produced with the same code letters, the first of the 6 digits is replaced by a letter.

Additionally there is a sticker on the toothed belt guard with “engine code” and “serial number”.

The engine code is also located on the vehicle data sticker. The vehicle data sticker is located in the Servicing schedule and in rear of vehicle in the spare wheel recess or the luggage compartment floor.

1.2 Engine data

Engine code		BKC	BLS	BRM	BXE
Manufactured		05.05 ▸	05.05 ▸	11.04 ▸	03.06 ▸
Emissions fulfil		EU4 standard	EU4 standard	Tier 2	EU4 standard
Capacity	l	1.9	1.9	1.9	1.9
Power output	kW at rpm	77/4000	77/4000	74/4000	77/4000
Torque	Nm at rpm	250/1900	250/1900	250/1900	250/1900
Bore	∅ in mm	79.5	79.5	79.5	79.5
Stroke	mm	95.5	95.5	95.5	95.5
Valves per cylinder		2	2	2	2
Compression ratio		19.0	19.0	19.0	19.0
CN	at least	51	51	51	51
Firing order		1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Catalytic converter		yes	yes	yes	yes
Exhaust gas recirculation		yes	yes	yes	yes
Diesel particulate filter		no	depending on version	no	no
Lambda control		no	yes	no	no
Turbocharging/supercharging		yes	yes	yes	yes
Charge air cooler		yes	yes	yes	yes
Electronic power control		yes	yes	yes	yes

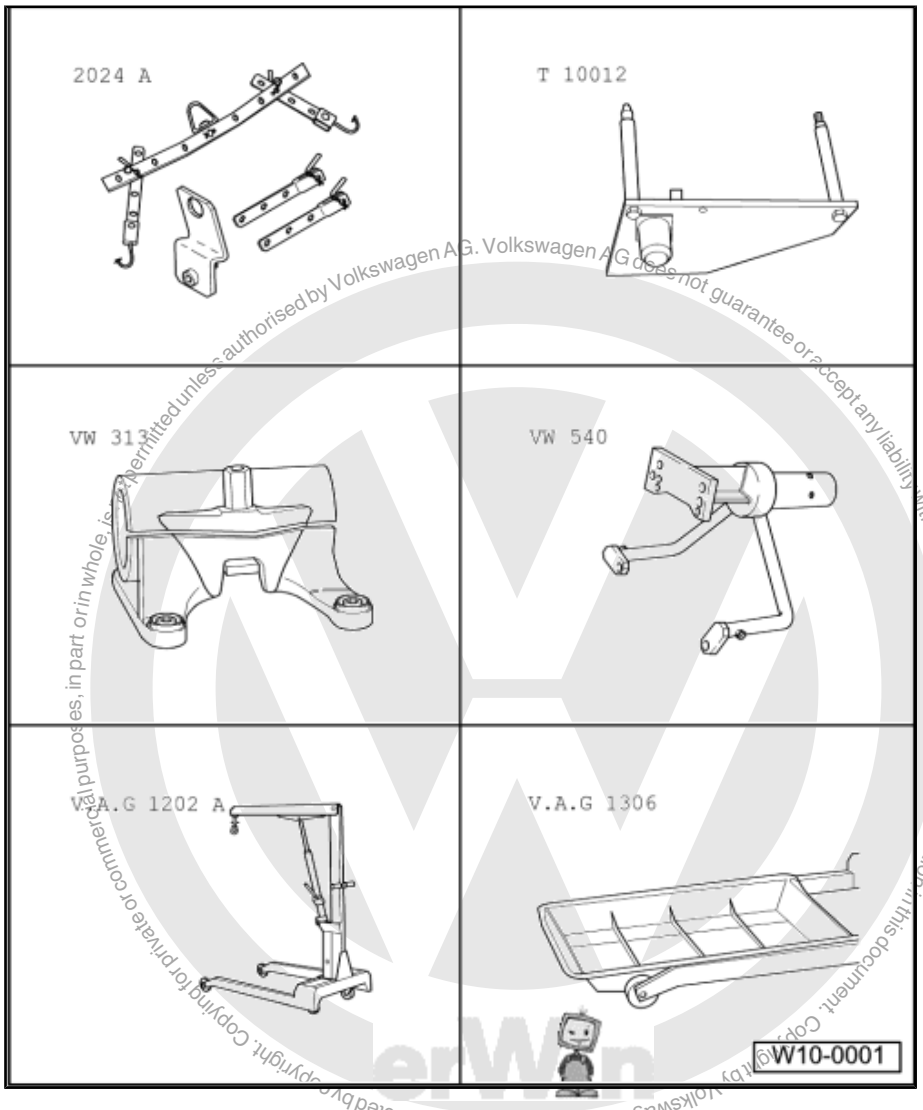
10 – Removing and installing engine

1 Removing and installing engine

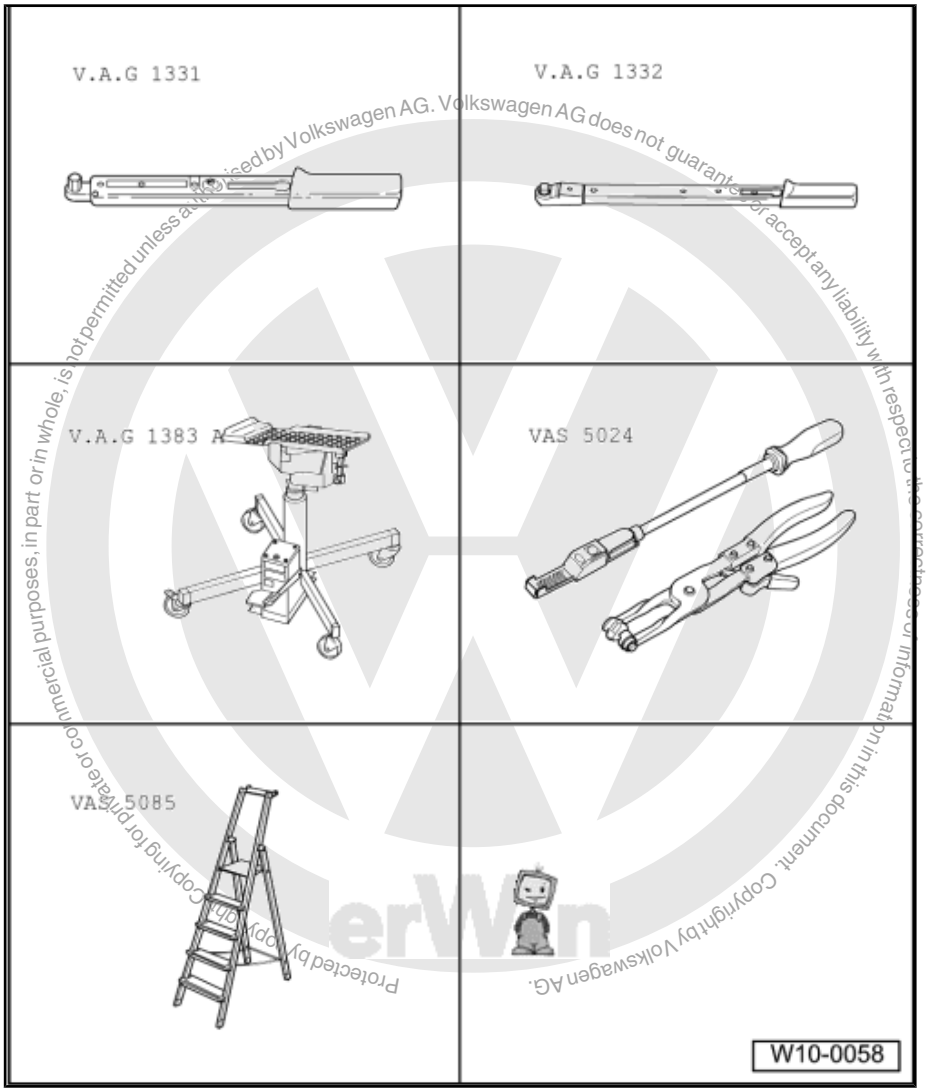
1.1 Removing engine

Special tools and workshop equipment required

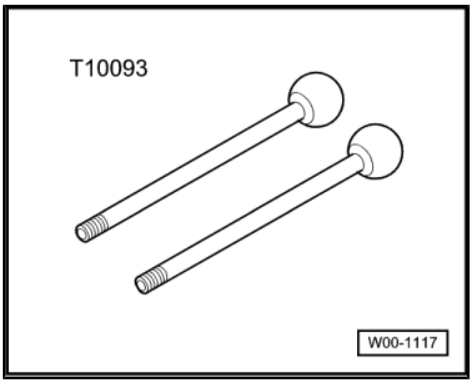
- Lifting tackle -2024 A-
- Engine support -T10012-
- Support clamp -VW 313-
- Engine and gearbox support -VW 540-
- Workshop crane -VAS 6100- or
- Workshop crane -V.A.G 1202 A-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-



- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1332-
- Engine and gearbox jack -V.A.G 1383 A-
- Spring-type clip pliers -VAS 5024A-
- Stepladder -VAS 5085-



- Guide rods -T10093-



- Cable ties

Note

- *Before carrying out further work, disconnect battery earth strap. First check whether a coded radio is fitted. Obtain anti-theft code first if necessary.*
- *The engine is removed downwards together with the gearbox.*
- *Renew all cable ties which are opened or cut open when removing the engine. Refit in the same position when installing the engine.*

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

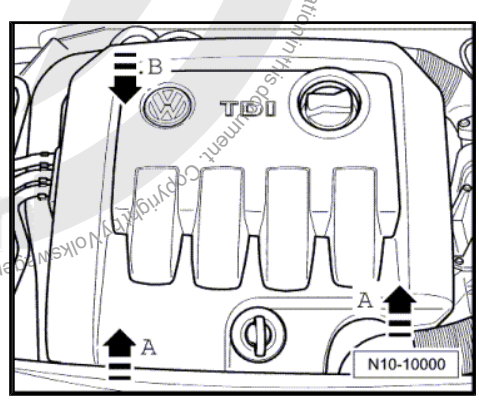
- ***All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***

Procedure

– With ignition switched off, disconnect earth strap from battery.

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Remove bulkhead in plenum chamber ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Plenum chamber bulkhead .



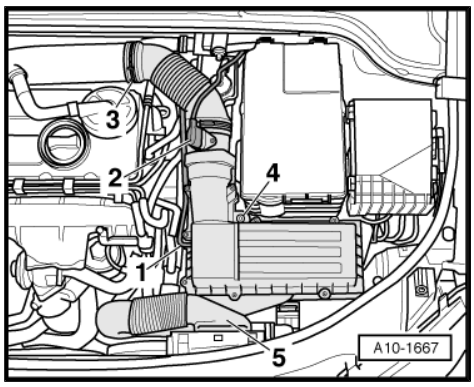
Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- and air duct hoses -3- and -5- off.

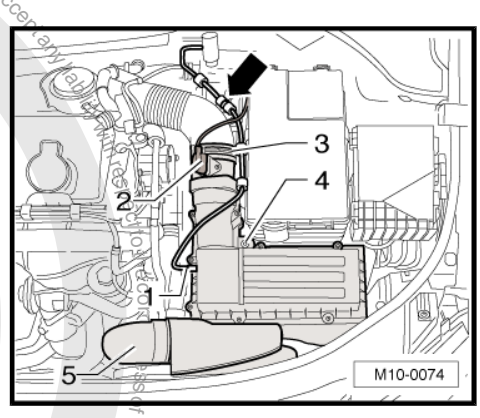
– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

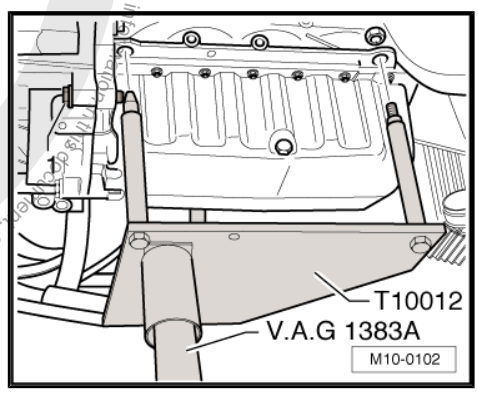
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.



Vehicles with diesel particulate filter

– Separate the following connectors -arrows- (on bulkhead):

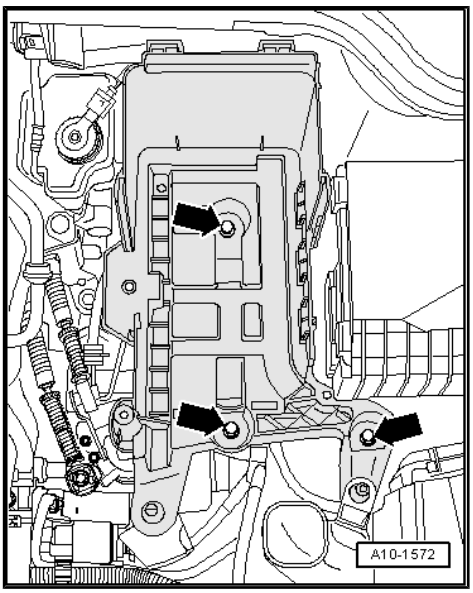
- Connector for charge pressure regulation solenoid valve - N75-
- Connector for bank 1 exhaust gas temperature sender 2 - G448-
- Connector for bank 1 exhaust gas temperature sender 1 - G235-
- Connector for Lambda probe -G39-



Continuation for all models

– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with diesel engine .

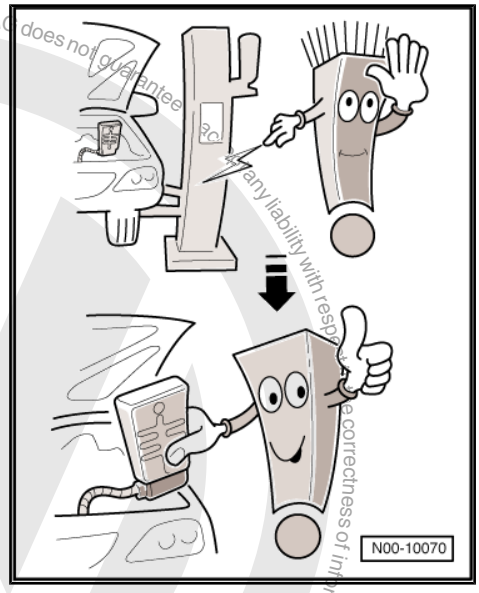
– Remove battery tray -arrows-.



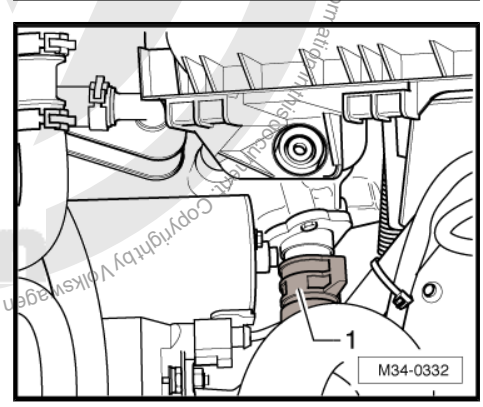
Vehicles with direct shift gearbox

If the metal components are touched it is possible to trigger an electrostatic discharge. This is due to the electrostatic charge of the human body. This charge can disturb the function of electrical components of the gearbox and of the shift mechanism.

– Before working on Mechatronic, touch an earthed object, such as a water pipe or a lifting platform.
– Do not touch connectors directly.

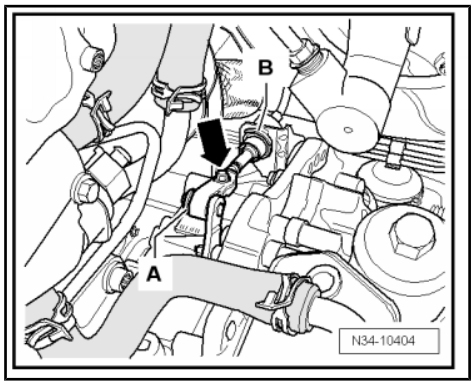


– Turn bayonet connection -1- of connector to left and pull connector off gearbox.

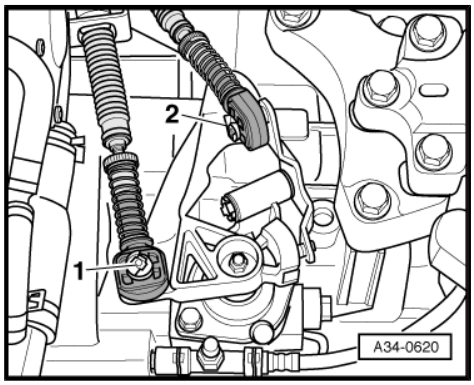


– Release retaining clip -A- off and remove upwards.
– Pull retaining clip -B- off upwards.
– Remove selector lever cable from selector shaft lever and place on the top.

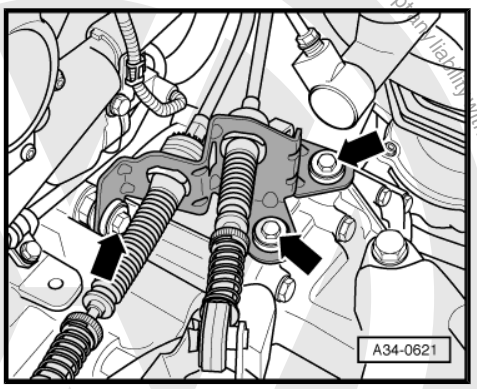
Vehicles with manual gearbox



– Unclip circlips -1- and -2- from both selector cables.
– Pull off selector cable end-pieces from gearbox selector lever and relay lever.



– Remove cable support bracket from gearbox -arrows- and lay to side.

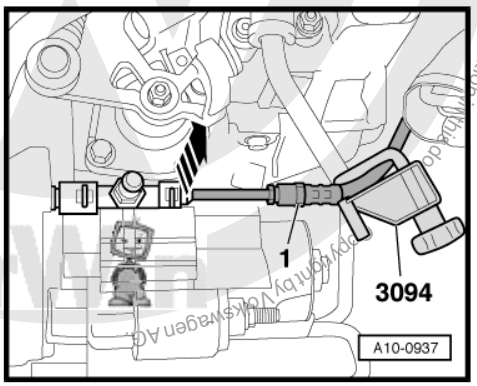


– Clamp off pressure line going to slave cylinder with hose clamps for diameters up to Ø 25 mm -3094- .

– Remove pressure line -1- out of hose coupling. To do this pull retaining clip upwards -arrow-.

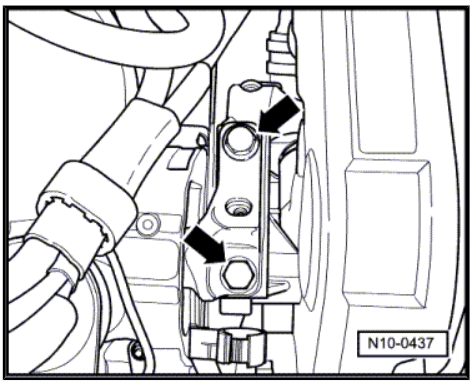
Caution

Do not press clutch pedal after removing slave cylinder.



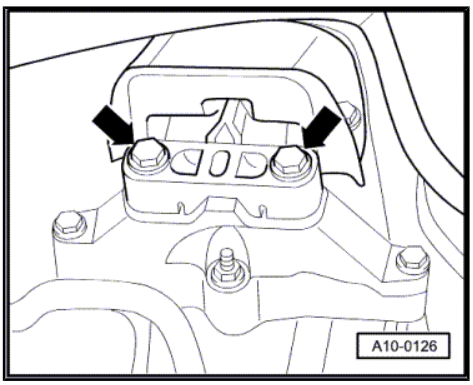
Continuation for all models

– Loosen bolts -arrows- of assembly mounting on engine just a bit (less than 1 turn).

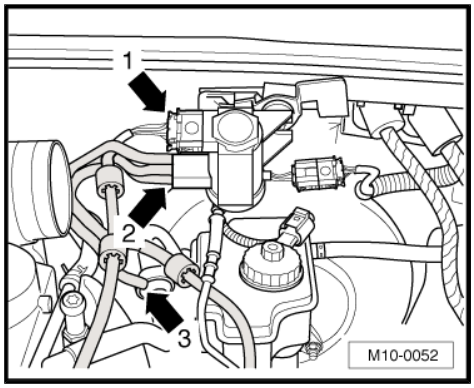


– Loosen bolts -arrows- of assembly mounting on gearbox just a bit (less than 1 turn).

Vehicles with engine codes BLS, BRM



– Pull connector -arrow 1- off.

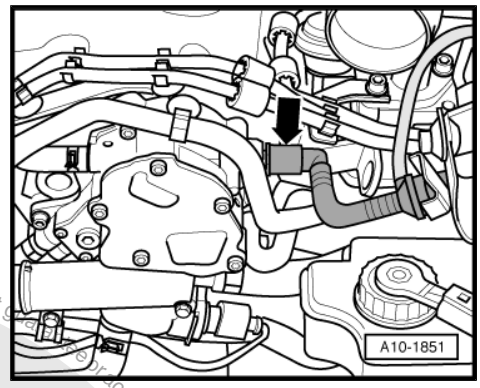


Continuation for all models

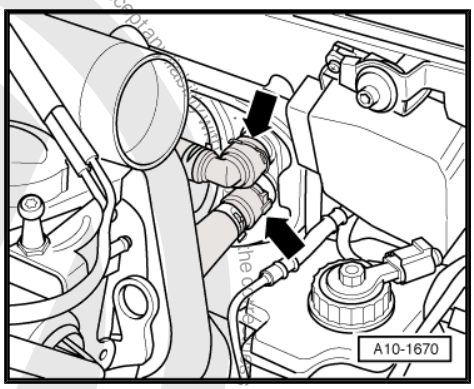
– Pull vacuum hoses -arrow 2- off.

– Pull vacuum hose -arrow 3- off non-return valve for brake servo.

– Pull vacuum hose -arrow- to brake servo off tandem pump.



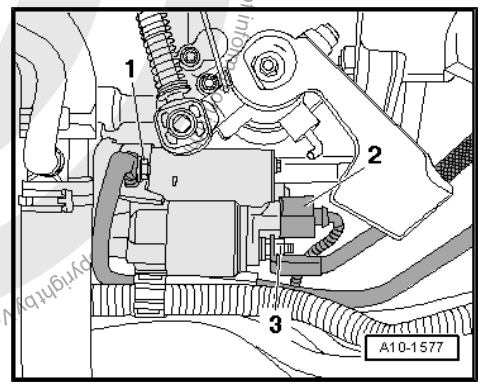
– Remove coolant hoses -arrows- to heater heat exchanger on bulkhead.



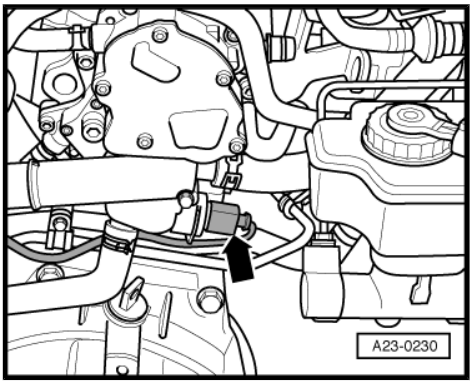
– Unscrew earth cable -1-.

– Remove wiring -2- and -3- on starter.

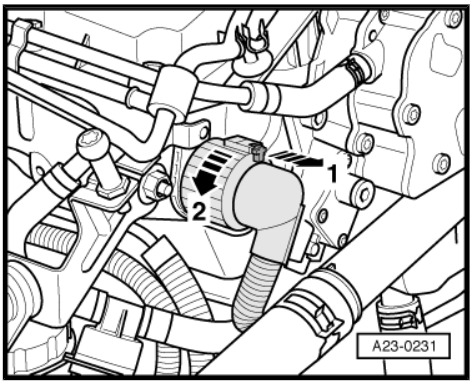
– Move wiring clear.



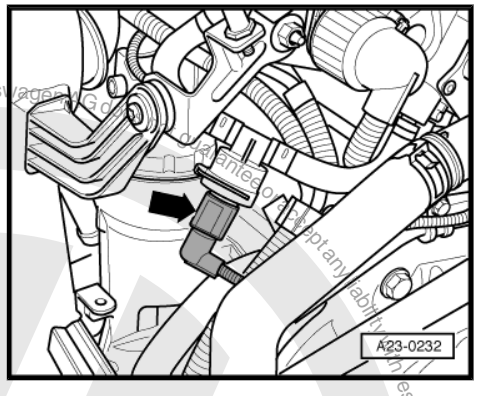
– Remove connector -arrow- on coolant temperature sender - G62- .



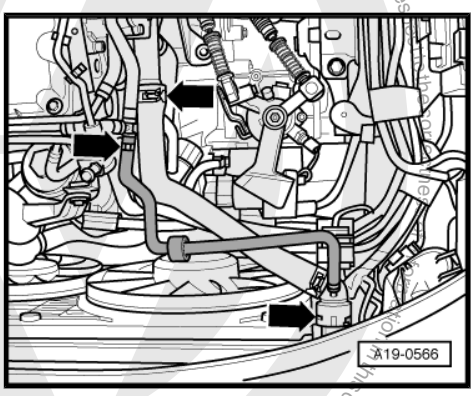
– Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
– Pull central switch for unit injectors off and free wiring harness.



– Disconnect connector -arrow- on fuel temperature sender - G81- and free wiring.



– Remove coolant hose between engine and radiator -arrows-.

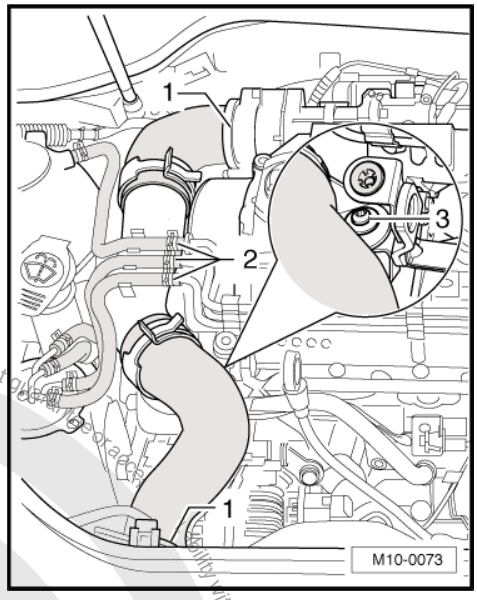


WARNING

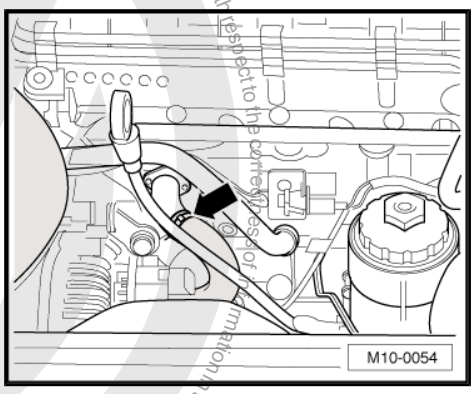
- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Mark and pull hoses -2- off and free.

– Remove air pipe. To do this lift retaining clips -1- slightly and remove the bolt -3- from the transport bracket.

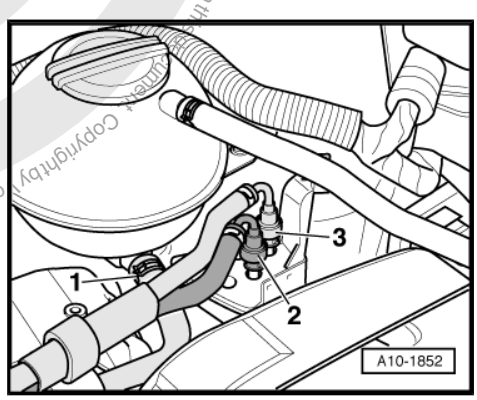


– Pull coolant hose -arrow- off.

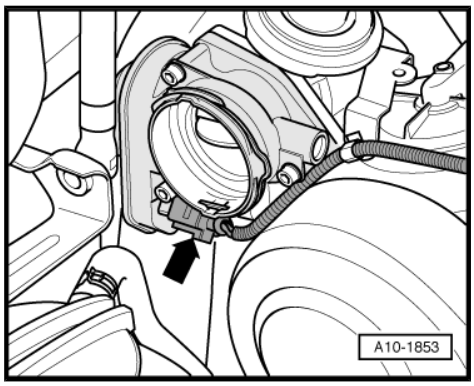


– Separate fuel supply pipe -3- and fuel return pipe -2-. To do this, pull release button.

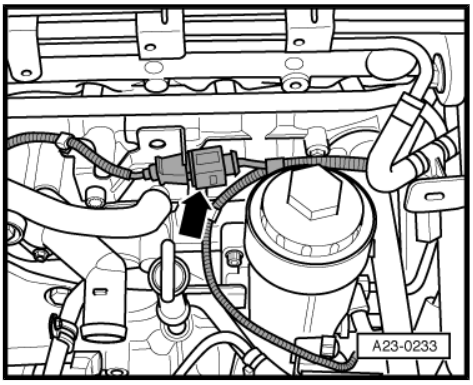
– Pull coolant hose -1- off expansion tank.



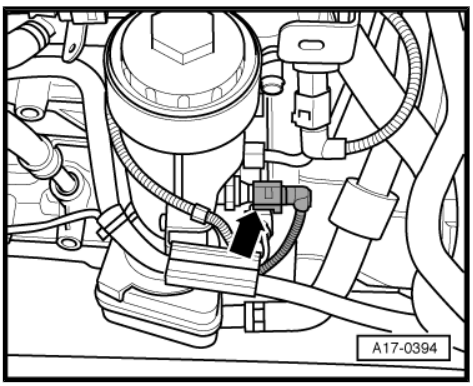
– Disconnect connector -arrow- on intake manifold flap motor -V157- .



– Take connector -arrow- for Hall sender -G40- out of retainer and separate.



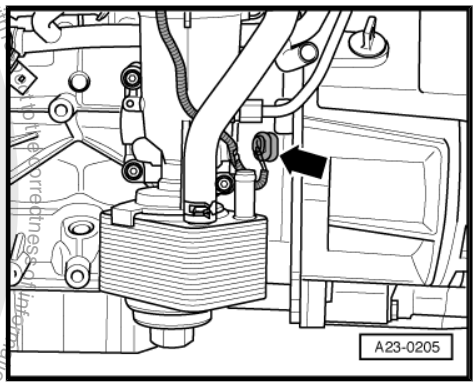
– Disconnect connector -arrow- on oil pressure switch -F1- .
– Unscrew oil pressure switch.



– Disconnect connector -arrow- on engine speed sender -G28- using assembly tool -T10118- .

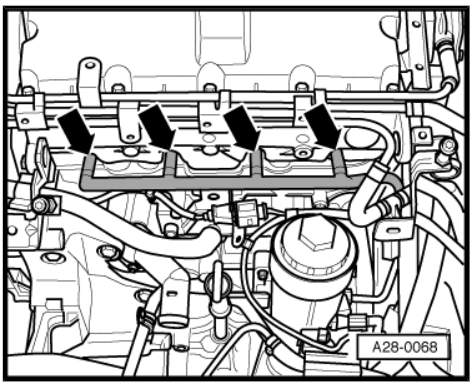
Note

To unlock connector without assembly tool -T10118- , press connector to engine speed sender with a screwdriver and raise release button with a thin wire hook at the same time.



– Move wire clear.

– Pull connector strip off glow plugs -arrows-.
– Free wiring to body.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. Gr. 50 ; Lock carrier .



Vehicles with air conditioner

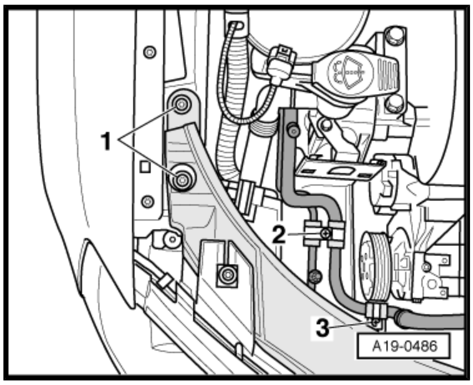
Note

To prevent damage to condenser or to refrigerant pipes and hoses, ensure that pipes and hoses are not stretched, kinked or bent.

WARNING

The air conditioner refrigerant circuit must not be opened.

– Remove bolts -2- and -3- on refrigerant lines brackets.



To facilitate removing and installing engine without opening refrigerant circuit:

– Remove poly-V-belt ⇒ page 29 .

– Separate air conditioner compressor ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .

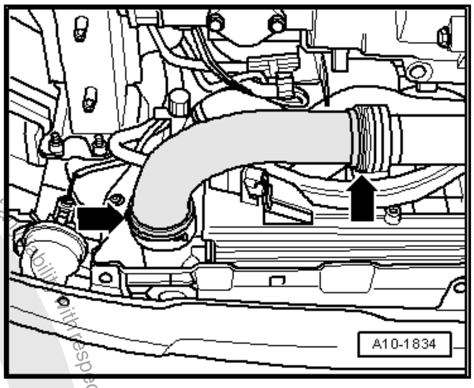
– Secure air conditioner compressor to lock carrier so that refrigerant lines are free of stress.

Continuation for all models

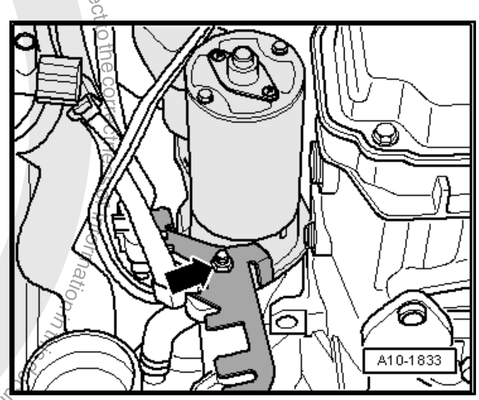
– Remove alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator 1.9 l TDI engine .

– Remove radiator ⇒ page 132 .

– Remove left air duct hose, to do this lift retaining clips -arrows- lightly.

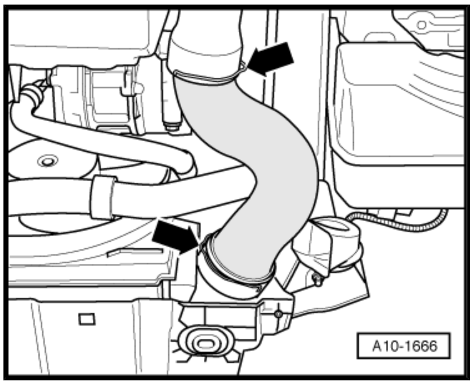


– Unscrew nut -arrow- and take retainer for wiring harness off threaded stud.

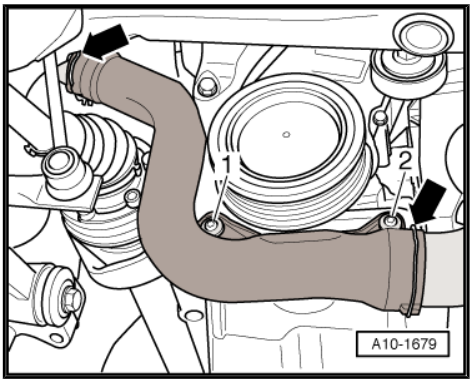


Vehicles with engine codes BKC, BXE

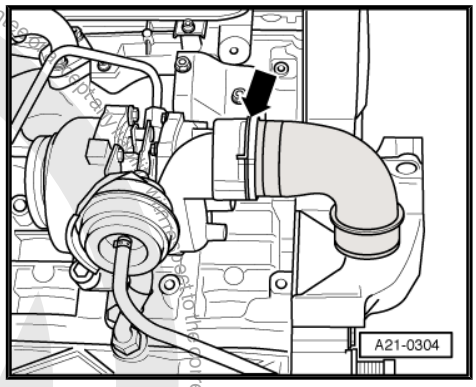
– Remove right air duct hose, to do this lift retaining clips -arrows- lightly.



– Remove bolts -1- and -2-.

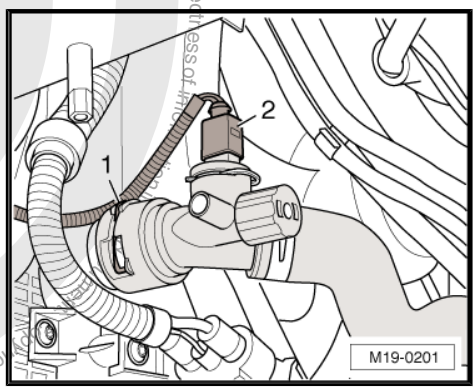


– Remove air hose from turbocharger. To do this lift retaining clip -arrow- lightly.
– Remove right air duct pipe. To do this lift retaining clips -arrow- lightly.

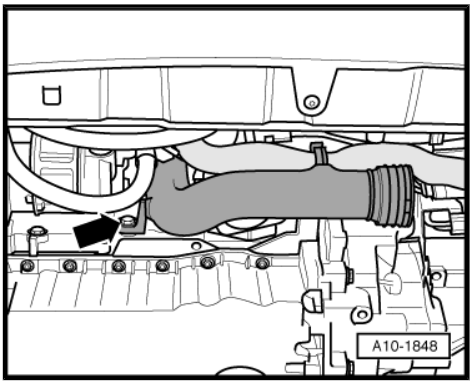


– Remove connector -2- on radiator outlet coolant temperature sender -G83- .

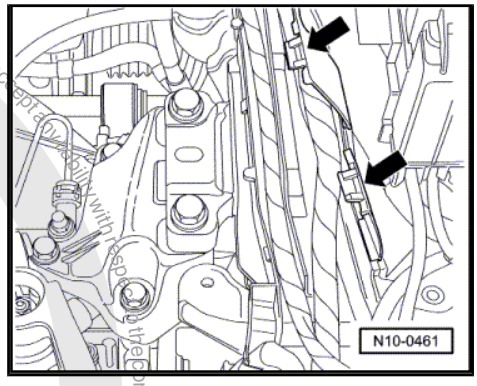
Continuation for all models



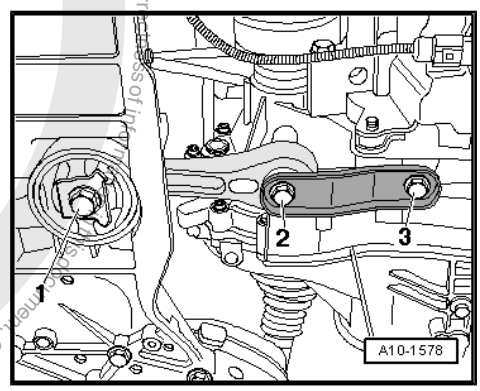
– Remove locking screw -arrow- for front air duct pipe.
– Remove right-hand and left-hand drive shafts on gearbox ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .
– Remove front exhaust pipe ⇒ page 251 .
– Disengage and pull off connector on engine control unit ⇒ page 245 .



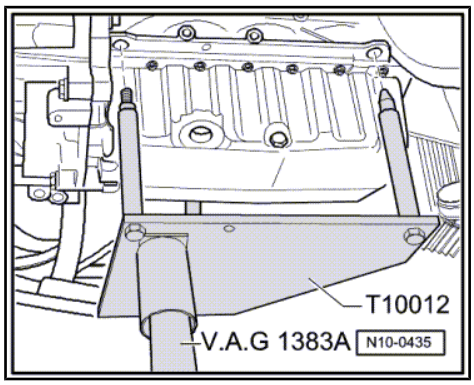
– Open all cable guide fasteners -arrows-.
– Remove wiring harness from cable guide on longitudinal member and lay to side on engine.
– Pull off or disconnect all other electrical connections from engine and gearbox as necessary and lay to side.
– Separate all connection, coolant, vacuum and intake hoses from engine.



– Unscrew bolt -1 - first.
– Unscrew bolts -2- and -3- and take pendulum support off.



– Insert engine support -T10012- in engine and gearbox jack -V.A.G 1383 A- .



Note

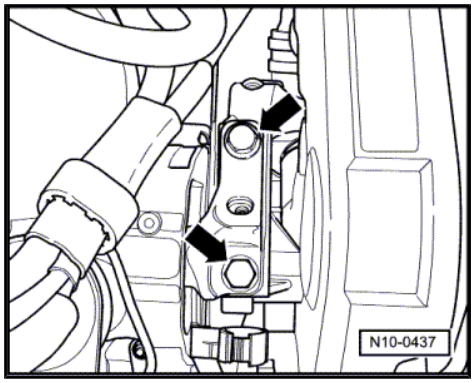
Support pins must be secured to engine bracket -T10012- as shown.

– Fit engine bracket -T10012- to cylinder block with bolt -M10×25/8.8- and tighten to approx. 40 Nm.
– Raise engine and gearbox slightly using engine and gearbox jack -V.A.G 1383 A- .

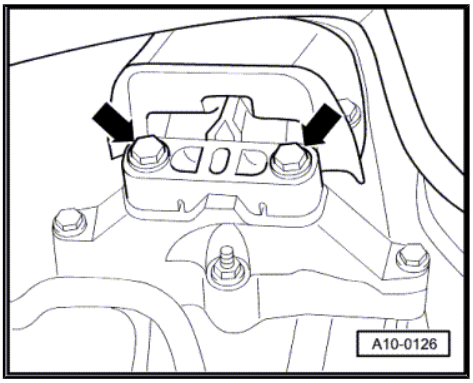
Note

To remove securing bolts use step ladder -VAS 5085- .

– Unbolt assembly mounting on engine side from engine bracket -arrows-.



– Unbolt assembly mounting on gearbox side from gearbox bracket -arrows-.



Note

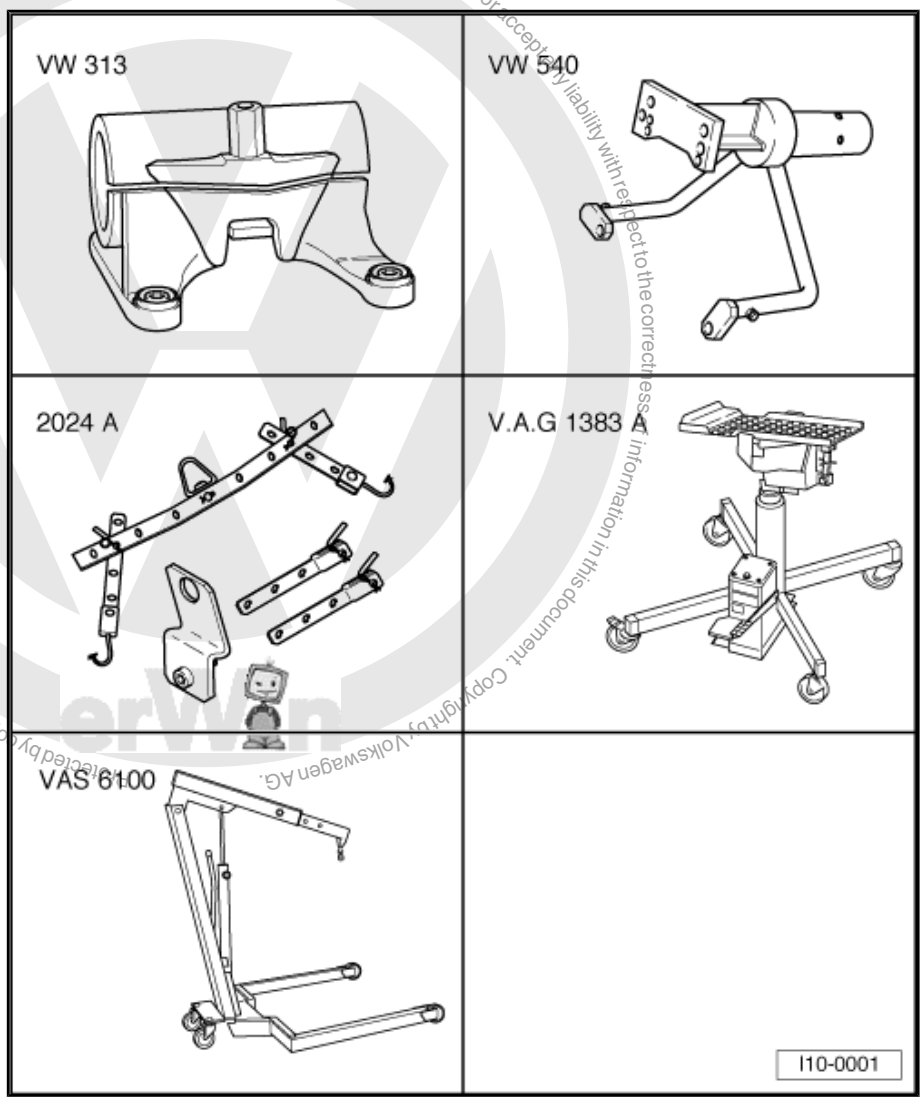
- *Check whether all hoses and wiring connections between engine, gearbox and body are disconnected.*
- *Engine with gearbox must be guided carefully when lowered to prevent damage.*

– Carefully lower engine with gearbox.

1.2 Securing engine to assembly stand

Special tools and workshop equipment required

- Support clamp -VW 313-
- Engine and gearbox support -VW 540-
- Lifting tackle -2024 A-
- Engine and gearbox jack - V.A.G 1383 A-
- Workshop crane - VAS 6100-



When working on the engine, secure it to support clamp -VW 313- of the assembly stand using engine and gearbox support -VW 540- .

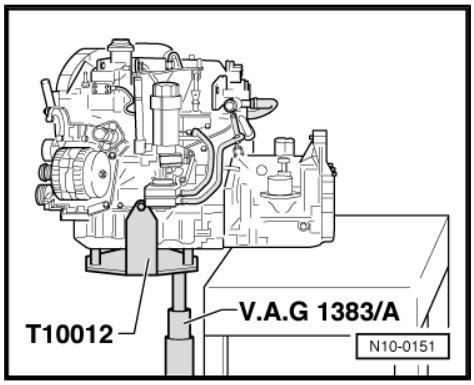
Procedure

– Move engine/gearbox jack -V.A.G 1383 A- to a workbench.

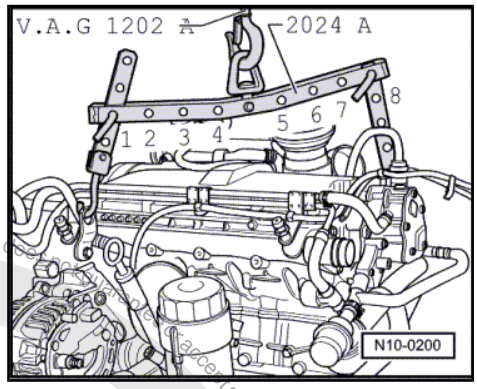
– Lower engine/gearbox assembly so that the gearbox is on the workbench.

– Remove engine/gearbox connecting bolts.

– Press gearbox off engine.



– Attach lifting tackle - 2024 A- as shown and raise engine out of engine and gearbox jack -V.A.G 1383 A- using workshop hoist -VAS 6100- or workshop hoist -V.A.G 1202 A- .



Belt pulley end: 1st hole of hook rail in position 2

Flywheel end: 4th hole in hook at position 8.

WARNING

The hooks and locating pins must be secured with locking pins.

Note

- *The positions marked 1...4 on the bar must be towards the pulley end.*
- *The holes in the hooks are counted up from the hook.*

– Secure engine on support clamp -VW 313- using engine and gearbox jack -VW 540- .

1.3 Installing engine

Install in reverse order. In the process, note the following:

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***

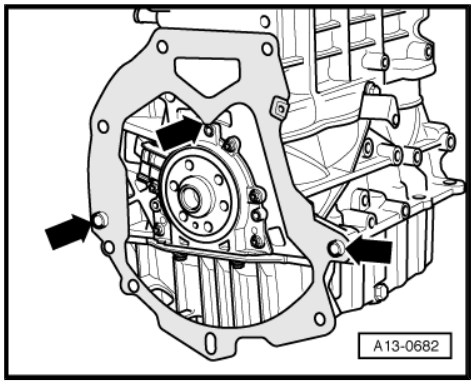
Note

- *Reinstall all cable ties in the same locations when assembling.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*

– Insert new dowel sleeves in cylinder block for centring engine and gearbox.

– Ensure that the intermediate plate is attached to the sealing flange and is slid onto the dowel sleeves -arrows-.

– Align engine mountings tension free by shaking. If necessary, loosen engine mounting on body.



Note

- *Checking and adjusting assembly mounting ⇒ page 19 .*
- *Torque settings for assembly mounting ⇒ page 23 .*
- *Engine/gearbox connecting bolts ⇒ Direct manual gearbox; Rep. Gr. 34 ; Removing and installing gearbox .*
- *Electrical connections and routing ⇒ Electrical system; Rep. Gr. 97 .*

Procedure

– Install pendulum support ⇒ page 23 .

– Install drive shafts ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .

– Remove front exhaust pipe ⇒ page 251 .

Vehicles with manual gearbox

– Install hydraulic clutch hydraulic lines ⇒ 6-speed manual gearbox 02Q; Rep. Gr. 30 ; Repairing clutch control; Assembly overview - Hydraulics .

– Install selector mechanism, adjust selector mechanism if necessary ⇒ 5-speed manual gearbox 0A4; Rep. Gr. 34 ; Servicing selector mechanism .

Vehicles with direct shift gearbox

– Fit selector lever cable to gearbox ⇒ Direct manual gearbox; Rep. Gr. 34 ; Removing and installing selector lever cable .

Continuation for all models

– Install alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator 1.9 l TDI engine .

– Install air conditioner compressor ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .

– Install poly-V-belt ⇒ page 29 .

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Install engine control unit ⇒ page 245 .

– Install battery carrier first and tighten bolts -arrows-.

– Route wiring -2- as shown in the figure and fit to electronics box -1-.

– Install bulkhead in plenum chamber ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Plenum chamber bulkhead .

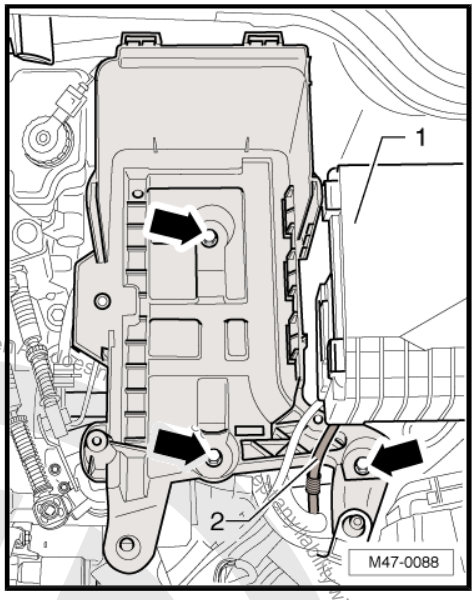
– Fill coolant system with coolant ⇒ page 127 .

– Installing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with diesel engine .

– Adapt engine control unit ⇒ Vehicle diagnosis, testing and information system -VAS 5051B - “Guided fault finding”.

– Perform vehicle system test using ⇒ Vehicle diagnosis system, testing and information system -VAS 5051B - “Guided fault finding”.

– Then end “Guided fault finding”.



Observe applicable safety precautions during road test.

– Carry out a road test.

– After this, perform vehicle system test again and if necessary, rectify faults.

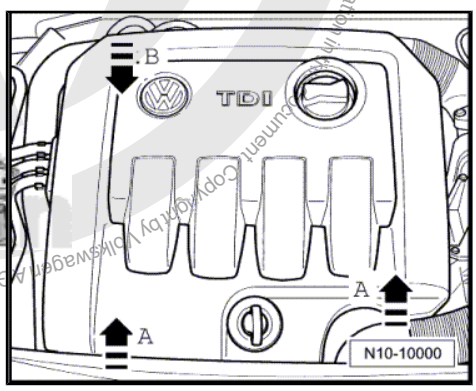
1.4 Checking and adjusting assembly mounting

Checking settings ⇒ page 19

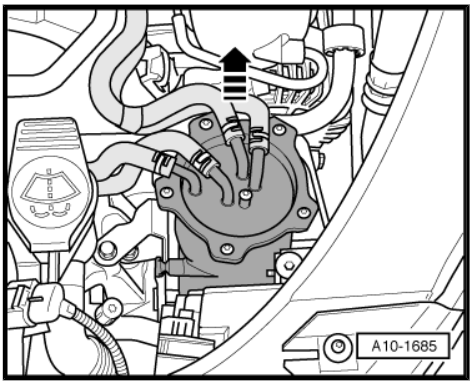
Adjusting assembly mounting ⇒ page 20

1.4.1 Checking

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

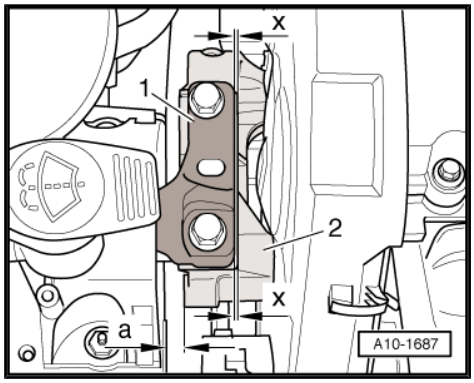


– Unlock locking devices and remove fuel filter with connected hoses from retainer upwards -arrow- and place to side.



The following specifications must be obtained:

- There must be a distance of -a- at least 10 mm between engine support and longitudinal member (right-side).
- The side surface of the engine support -2- should be located parallel to the support arm -1-. Dimension -x- must be identical at top and bottom.



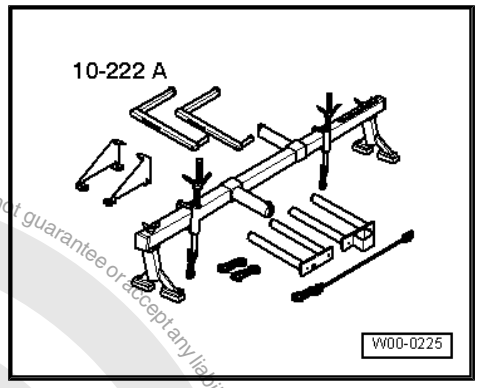
Note

Distance -a- = 10 mm can also be checked with a metal rod of suitable size, or similar.

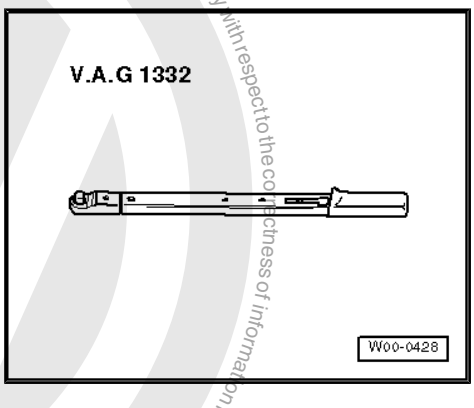
1.4.2 Adjusting assembly mounting

Special tools and workshop equipment required

- Support bracket -10 - 222 A-



- Torque wrench -V.A.G 1332-



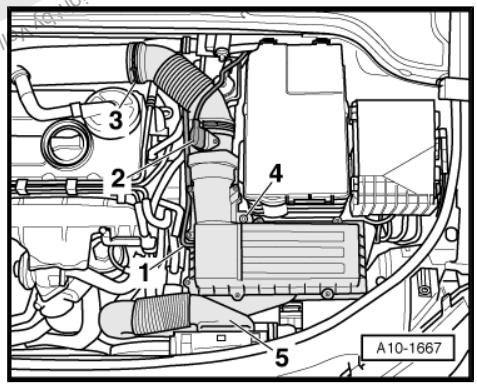
If dimension is too small or to large proceed as follows:

Vehicles with engine codes BKC, BXE

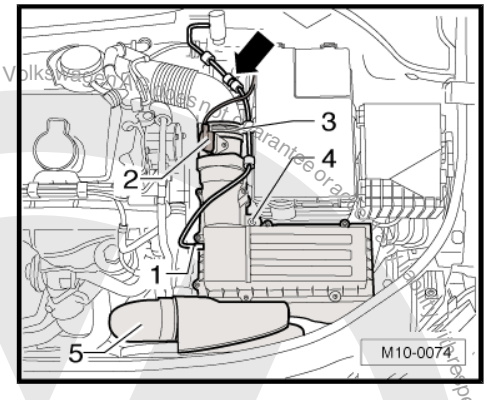
– Remove air filter housing with air mass meter and connecting pipe.
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- and air duct hoses -3- and -5- off.
– Unscrew bolt -4- and take off air filter housing.

Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

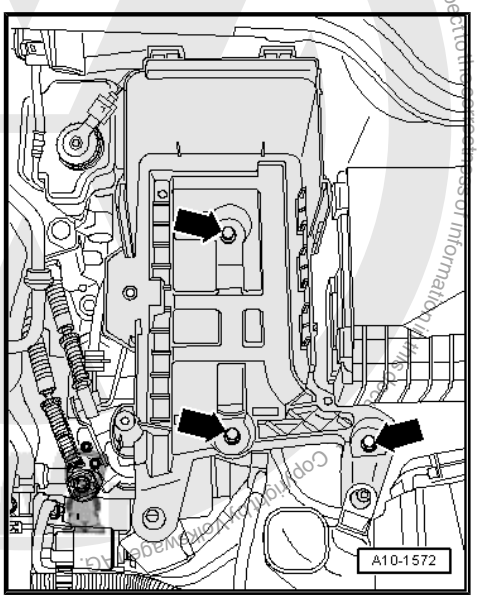


– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.

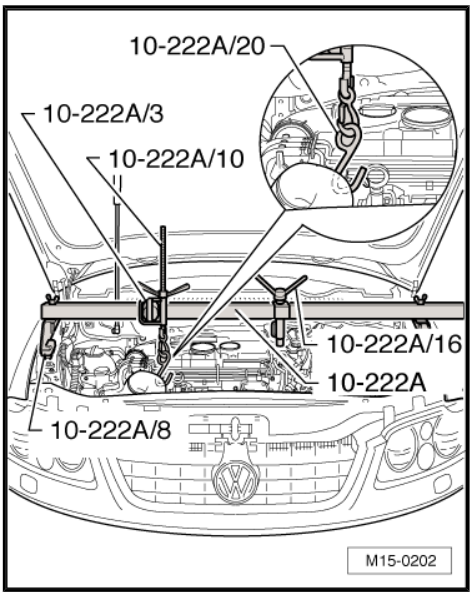


Continuation for all models

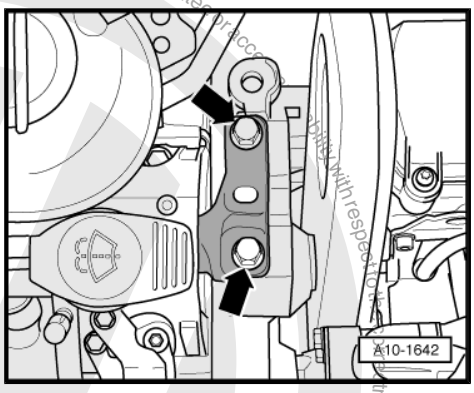
– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with diesel engine .
– Remove battery tray -arrows-.



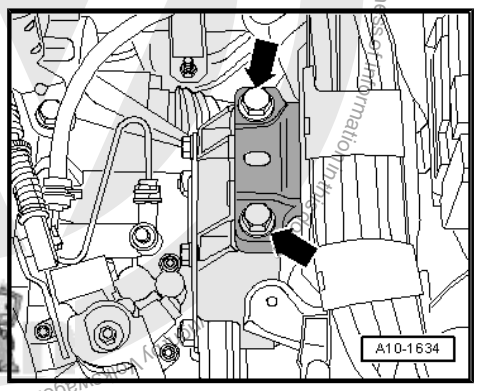
– Fit support bracket -10 - 222 A- before the gas pressure damper for the front flap using adapter -10 - 222 A/8- , adapter - 10 - 222 A/3- and adapter -10 - 222 A/16- .
– Attach trigger snap of spindles to lifting eyes. On the right side use additionally the adapter -10 - 222 A/20-
– Take up weight of engine evenly with both spindles (but do not raise engine).



– Remove bolts -arrows- of engine assembly mounting.

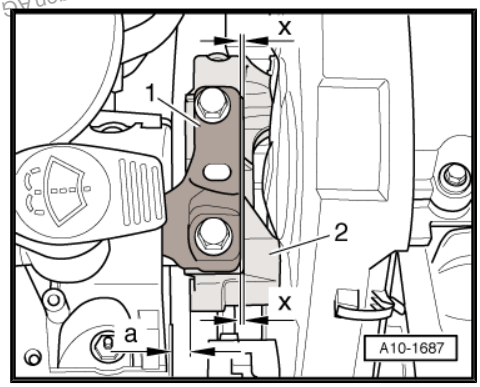


– Remove bolts -arrows- of gearbox assembly mounting.
– Renew all bolts one after the other (if they had not been removed when the engine was removed) and screw in loosely.



– Slide the engine with a lever between engine console -1- and arm -2- until the following dimensions are set:

- Between the engine support and the right longitudinal member there must be a distance of -a- = 10 mm.
- The side surface of the engine support -2- should be located parallel to the support arm -1-. Dimension -x- must be identical at top and bottom.

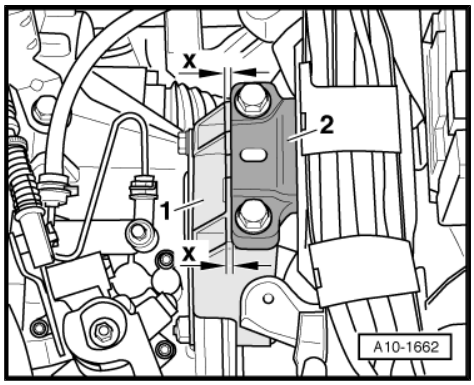


Note

Dimension -a- can be checked e.g. with suitable round bars.

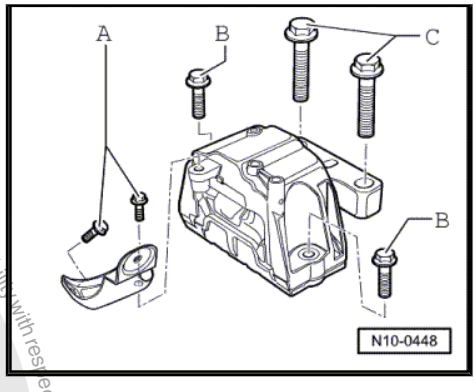
– Tighten bolts for engine side assembly mounting ⇒ page 23 .

– Ensure that the edges of the support arm on the gearbox assembly mounting -2- and gearbox support -1- are parallel. Dimension -x- must be identical at top and bottom.
– Tighten bolts for gearbox side assembly mounting ⇒ page 23 .



Installation is carried out in the reverse order.

1.5 Assembly mounting - Torque settings



Engine assembly mounting

A = 20 Nm + 90° (1/4 turn) further

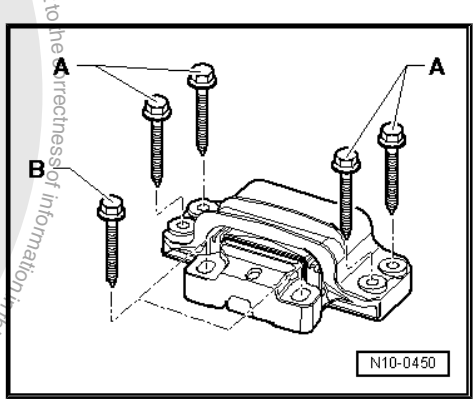
Renew bolts.

B = 40 Nm + 90° (1/4 turn) further

Renew bolts.

C = 60 Nm + 90° (1/4 turn) further

Renew bolts.



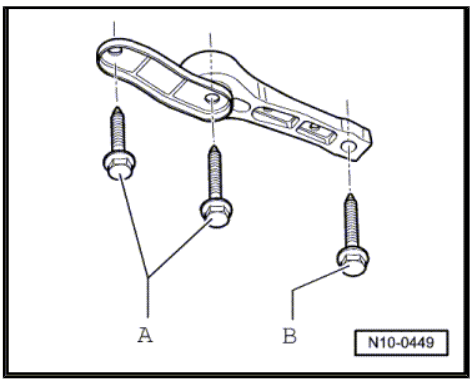
Gearbox assembly mounting

A = 40 Nm + 90° (1/4 turn) further

Renew bolts.

B = 60 Nm + 90° (1/4 turn) further

Renew bolts.



Pendulum support

A = 40 Nm + 90° (1/4 turn) further

Renew bolts.

B = 100 Nm + 90° (1/4 turn) further

Renew bolts.

Removing: First remove bolt -B- then bolts -A-.

Installing: First tighten bolts -A- then bolt -B-.

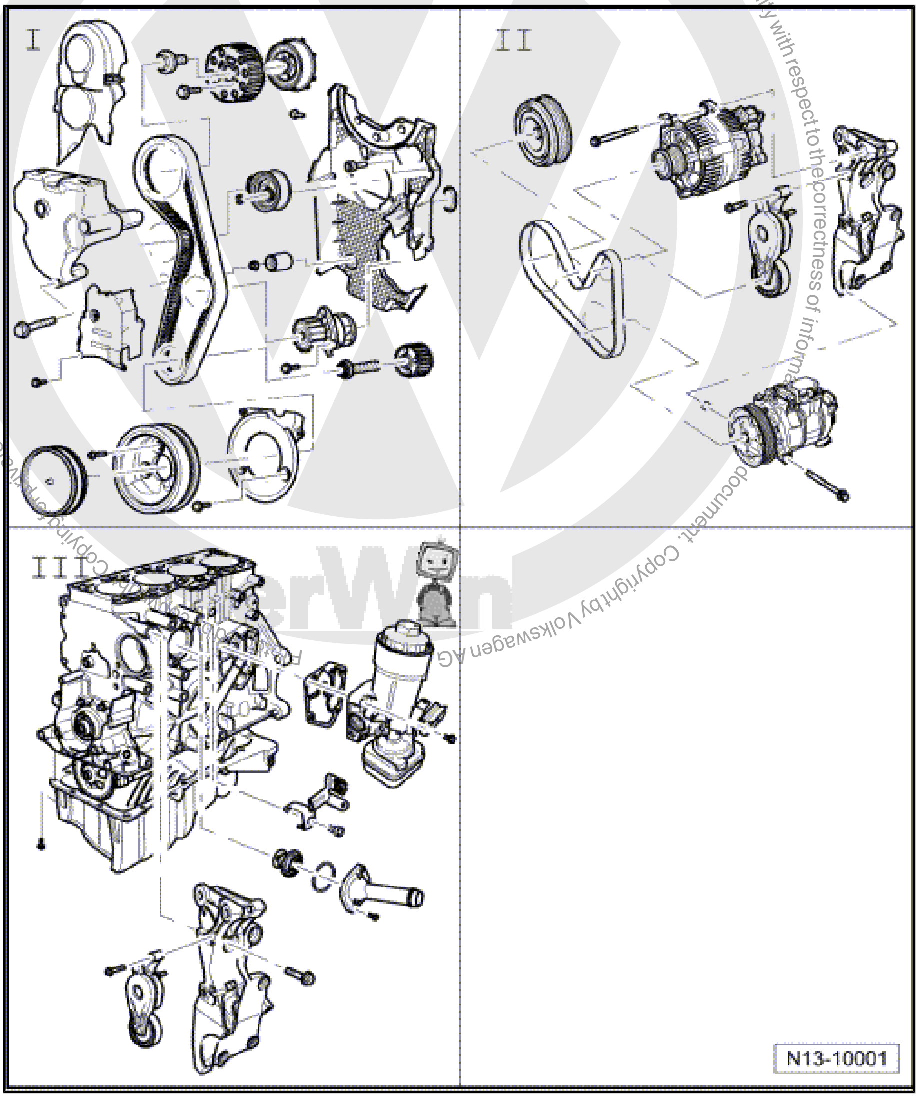
13 – Crankshaft group

1 Dismantling and assembling engine

Note

If large quantities of metal particles or other deposits (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil passages of the oil cooler, the oil spray jets and the oil filter thoroughly and renew the oil cooler in order to prevent further damage from occurring later.

1.1 Assembly overview

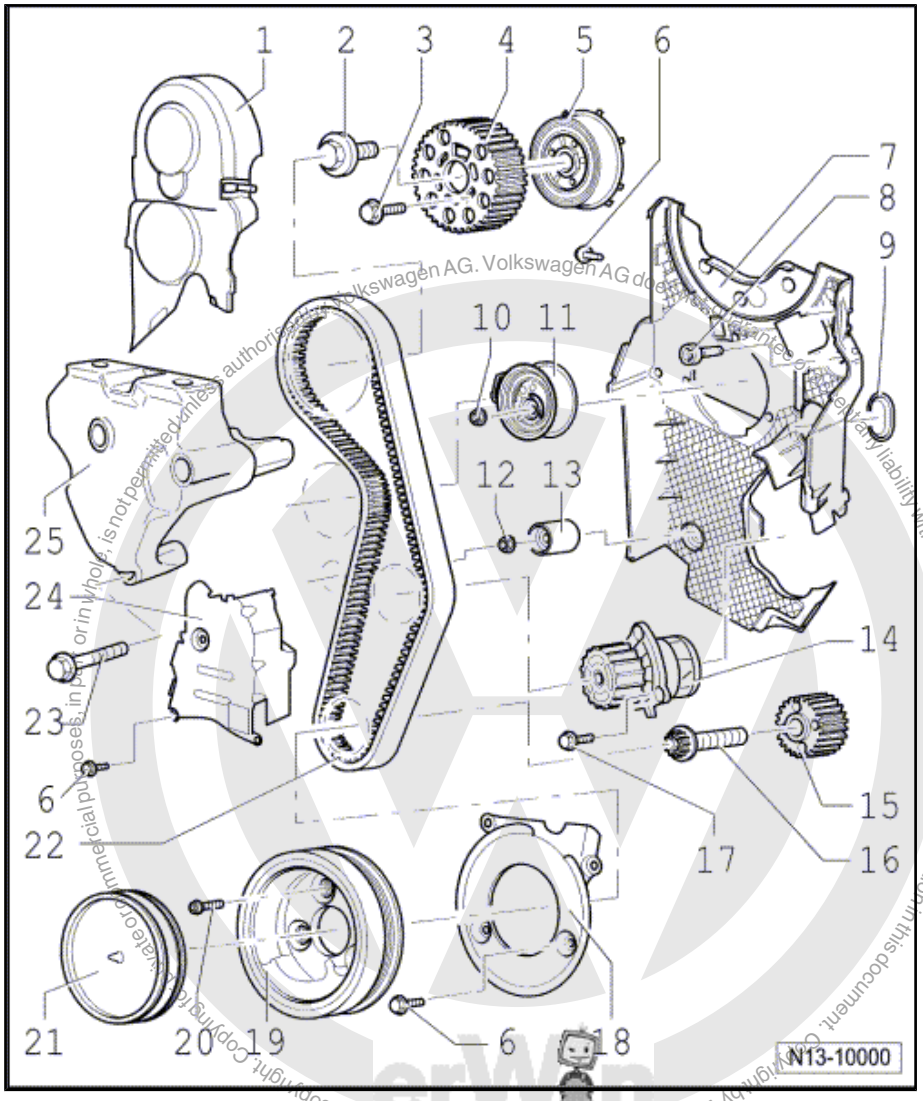


I = Toothed belt drive - Assembly overview ⇒ page 26

II = Poly-V-belt drive - Assembly overview ⇒ page 27

III = Cylinder block - Assembly overview ⇒ page 28

1.2 Assembly overview - toothed belt drive



1 - Toothed belt guard upper part

2 - 100 Nm

3 - 25 Nm

4 - Camshaft pulley

5 - Hub

- ❑ With sender wheel.
- ❑ Use counter-hold - T10051 - to loosen and tighten
- ❑ To remove, use puller - T10052- .
- ❑ Removing and installing ⇒ page 92 .

6 - 10 Nm

- ❑ Renew.

7 - Rear toothed belt guard

8 - 25 Nm

9 - Sealing grommet

- ❑ Renew if damaged.

10 - 20 Nm +45° (1/8 turn) further

11 - Tensioning roller

12 - 20 Nm

13 - Idler roller

14 - Coolant pump

- ❑ Removing and installing ⇒ page 134 .

15 - Crankshaft toothed belt pulley

16 - 120 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ Use counter-hold tool -3099- to loosen and tighten.
- ❑ Do not additionally oil or grease thread and shoulder.
- ❑ Turning further can be done in several stages.

17 - 15 Nm

18 - Toothed belt guard lower part

19 - Belt pulley and vibration damper

- ❑ Can only be installed in one position. Holes are offset.

20 - 10 Nm + 90° (1/4 turn) further

21 - Cover

22 - Toothed belt

- ❑ Mark direction of rotation before removing.
- ❑ Check for wear.
- ❑ Do not kink.
- ❑ Removing, installing and tensioning ⇒ page 62 .

23 - 40 Nm + 180° (1/2 turn) further

- ❑ Renew.

24 - Centre toothed belt guard

25 - Engine support

1.3 Assembly overview - poly-V-belt drive

1 - Belt pulley and vibration damper

- ❑ Can only be installed in one position. Holes are offset.

2 - 25 Nm

3 - Alternator

4 - Retainer

- ❑ For alternator and air conditioner compressor.

5 - Poly-V-belt tensioner

- ❑ Swing with ring spanner to slacken poly-V-belt.

6 - 25 Nm

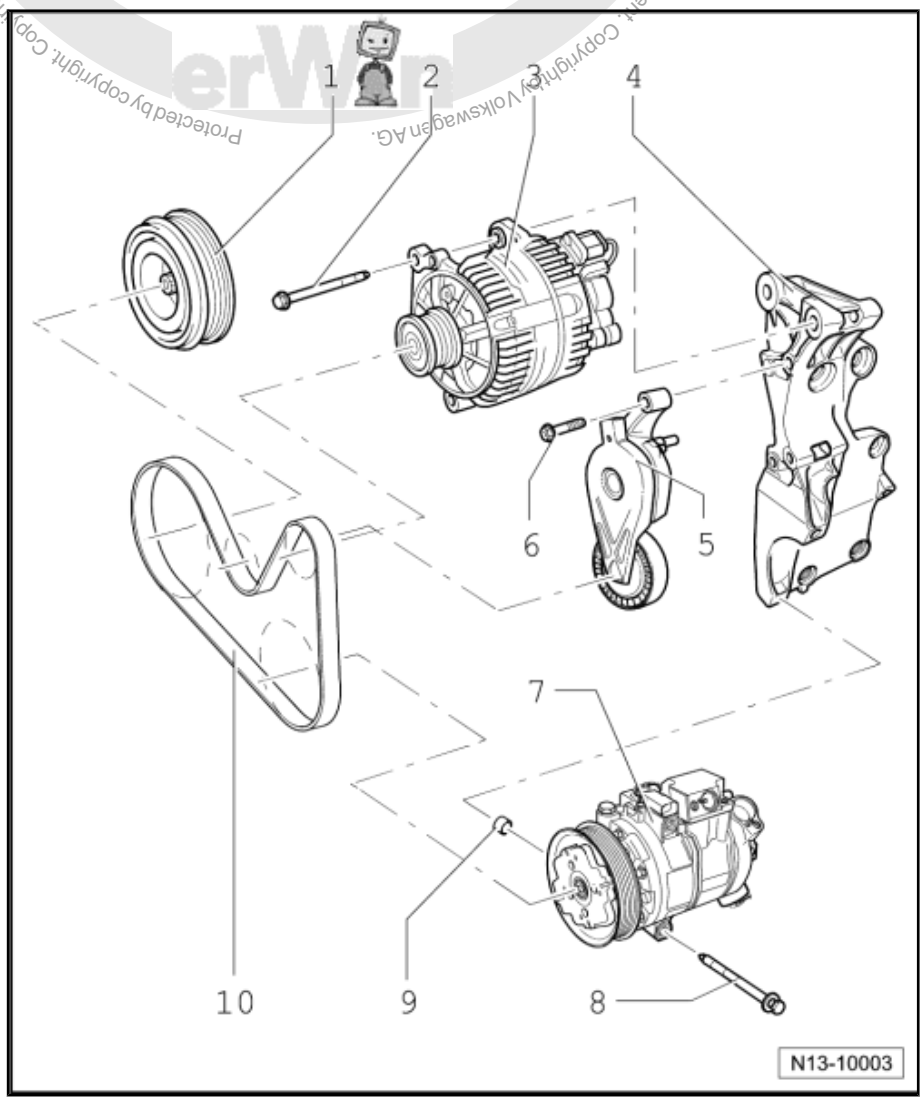
7 - Air conditioner compressor

8 - 25 Nm

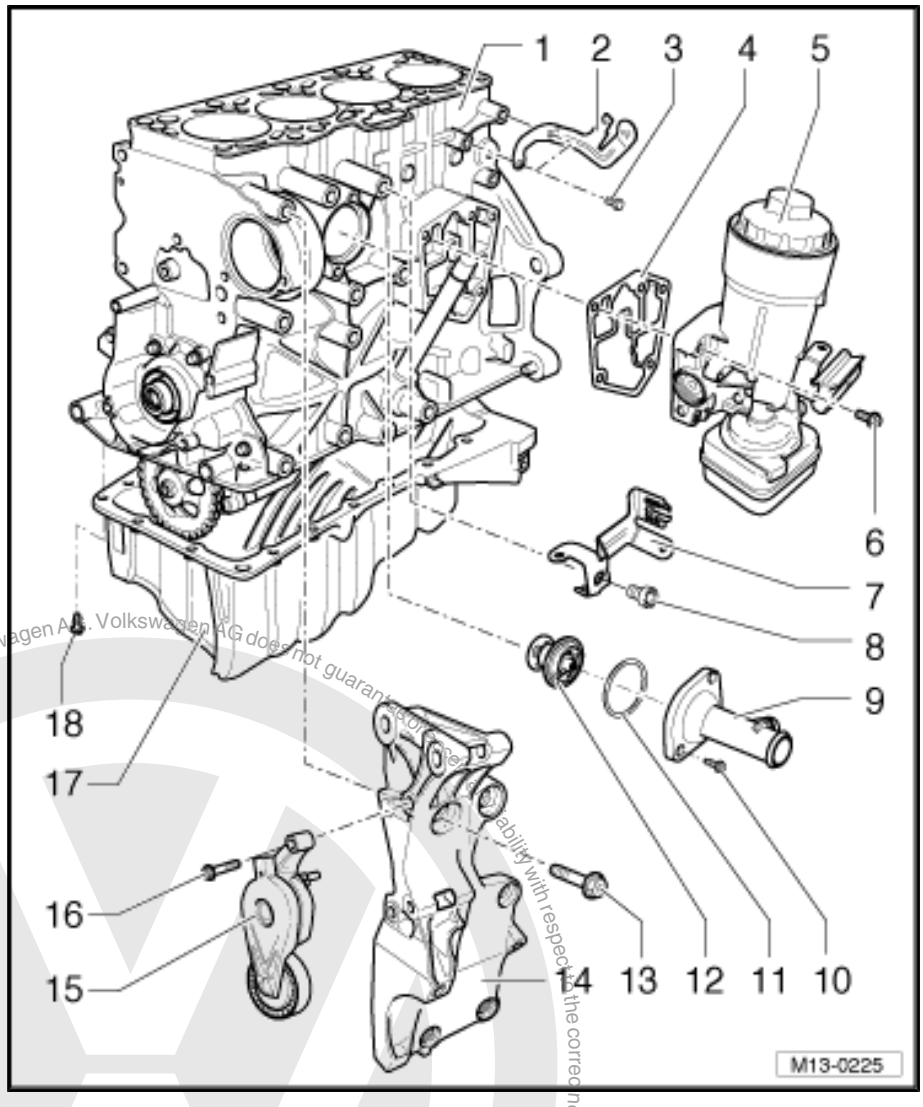
9 - Dowel sleeves

10 - Poly-V-belt

- ❑ Mark direction of rotation before removing.
- ❑ Check for wear.
- ❑ Do not kink.
- ❑ Removing and installing ⇒ page 29 .



1.4 Assembly overview - cylinder block



1 - Cylinder block

- ❑ Removing and installing sealing flange and flywheel ⇒ page 32 .
- ❑ Removing and installing crankshaft ⇒ page 48 .
- ❑ Dismantling and assembling pistons and conrods ⇒ page 48 .

2 - Retainer

- ❑ For wiring harness and charge air pipe

3 - 15 Nm

4 - Seal

- ❑ Renew.

5 - Oil filter bracket

- ❑ Removing and installing ⇒ page 107 .
- ❑ Dismantling and assembling ⇒ page 106

6 - 15 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ First fit upper left and lower right bolts and then tighten all four bolts diagonally.

7 - Retainer

8 - 20 Nm

9 - Connection

- ❑ For thermostat.

10 - 15 Nm

11 - O-ring

- ❑ Renew.

12 - Thermostat

- ❑ Removing and installing ⇒ page 136 .
- ❑ Note installation position ⇒ page 136 .
- ❑ Checking: heat thermostat in water.
- ❑ Opening begins at approx. 85°C.
- ❑ Ends at approx. 105°C.
- ❑ Opening lift min. 7 mm.

13 - Hexagon head bolt

- ❑ Tightening sequence and tightening torque: ⇒ Heating, air conditioning; Rep. Gr. 87 ; Removing and installing compressor bracket .

14 - Retainer

- ❑ For alternator and, if fitted, air conditioner compressor.

15 - Poly-V-belt tensioner

16 - 25 Nm

17 - Sump

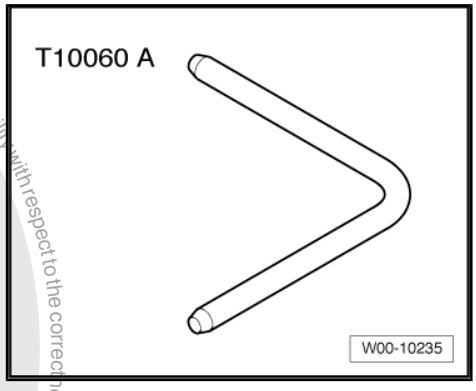
- ❑ Clean sealing surface before installing
- ❑ Install with silicone sealant -D 176 404 A2- .

18 - 15 Nm

1.5 Removing and installing poly-V-belt

Special tools and workshop equipment required

- ♦ Mandrel -T10060A-



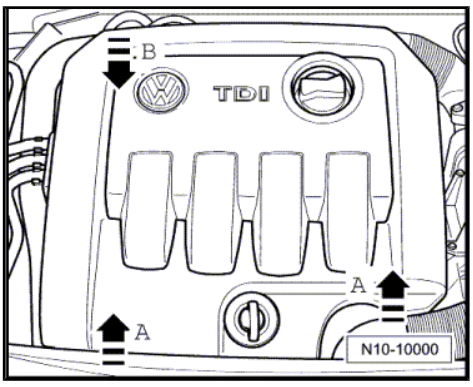
Removing ⇒ page 29

Installing ⇒ page 30

1.5.1 Removing

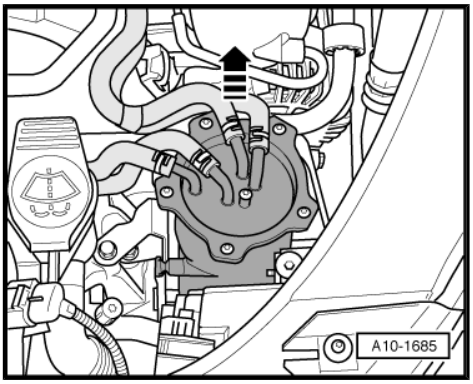
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

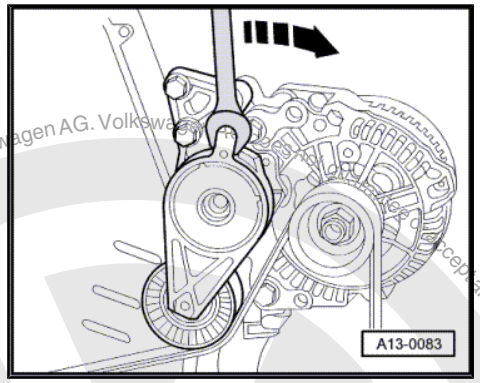


– Pull fuel filter out in -direction of arrow- and lay it with hoses to side.

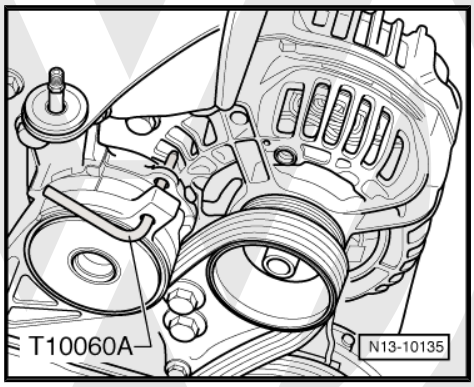
– Mark direction of rotation of poly-V-belt.



– Swing tensioning element in -direction of arrow- to remove tension from poly-V-belt.



– Lock tensioning element with retaining pin -T10060 A- .
– Remove poly-V-belt.



1.5.2 Installing

– Install in reverse order. In the process, note the following:

Note

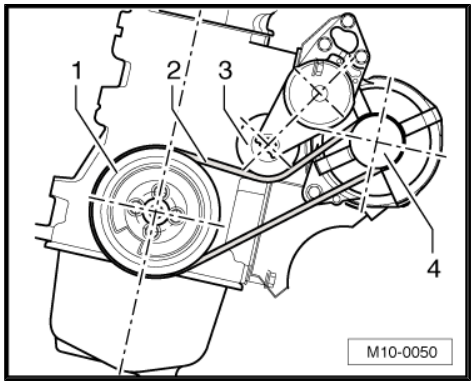
- *Ensure, before installing poly-V-belt, that all ancillaries (alternator, air conditioner compressor) are secured tightly.*
- *When fitting poly-V-belt, check direction of belt rotation and proper seating of belt in pulleys.*
- *Lastly, place poly-V-belt over alternator.*

After completing repairs always:

– Start engine and check how belt runs.

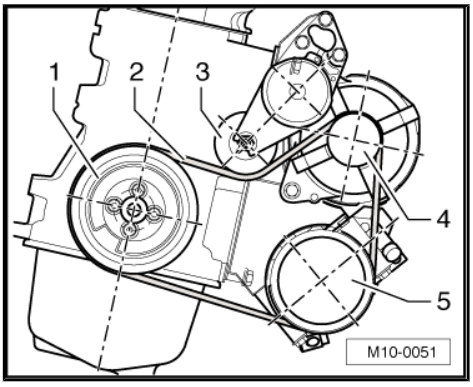
Belt drive without air conditioner compressor

1 - Crankshaft pulley
2 - Poly-V-belt
3 - Tensioning roller
4 - Alternator pulley



Belt drive with air conditioner compressor

1 - Crankshaft pulley
2 - Poly-V-belt
3 - Tensioning roller
4 - Alternator pulley
5 - Air conditioner compressor pulley



2 Removing and installing sealing flange and flywheel

Assembly overview - sealing flange and flywheel ⇒ page 32

Renewing crankshaft oil seal - belt pulley end ⇒ page 33

Removing and installing sealing flange - belt pulley end ⇒ page 33

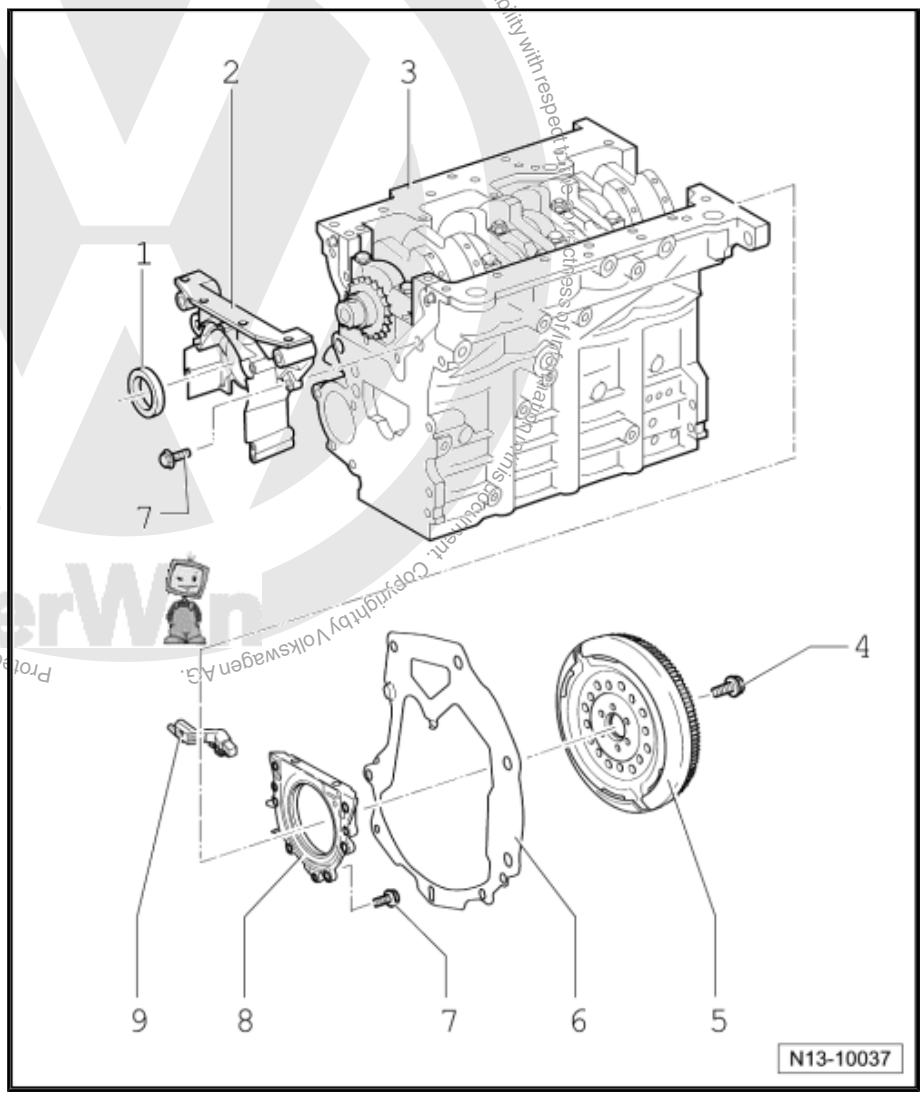
Renewing crankshaft sealing flange - flywheel end ⇒ page 38

Removing and installing dual-mass flywheel ⇒ page 45

2.1 Assembly overview - sealing flange and flywheel

Note

Servicing of coupling ⇒ 5-speed manual gearbox 0A4; Rep. Gr. 30 ; Service coupling or ⇒ Direct shift gearbox 02E; Rep. Gr. 30 ; Removing and installing coupling .



1 - Oil seal

- ❑ Do not additionally oil or grease sealing lip of oil seal
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth
- ❑ Renewing crankshaft oil seal - belt pulley end- ⇒ page 33

2 - Sealing flange - pulley end

- ❑ Must seat on dowel sleeves.
- ❑ Removing and installing ⇒ page 35
- ❑ Install with silicone sealing compound -D 176 404 A2- ⇒ page 35

3 - Cylinder block

- ❑ Removing and installing crankshaft ⇒ page 48
- ❑ Dismantling and assembling pistons and conrods ⇒ page 52

4 - 60 Nm + 90° (1/4 turn) further

- ❑ Renew.

5 - Flywheel

- ❑ When removing and installing flywheel, lock with counter-hold tool -3067- .

6 - Intermediate plate

- ❑ Must seat on dowel sleeves.
- ❑ Do not damage or bend when assembling.

7 - 15 Nm

- ❑ Renew.

8 - Sealing flange with oil seal.

- ❑ Renew complete with oil seal and sender wheel only.
- ❑ Removing and installing ⇒ page 38 .

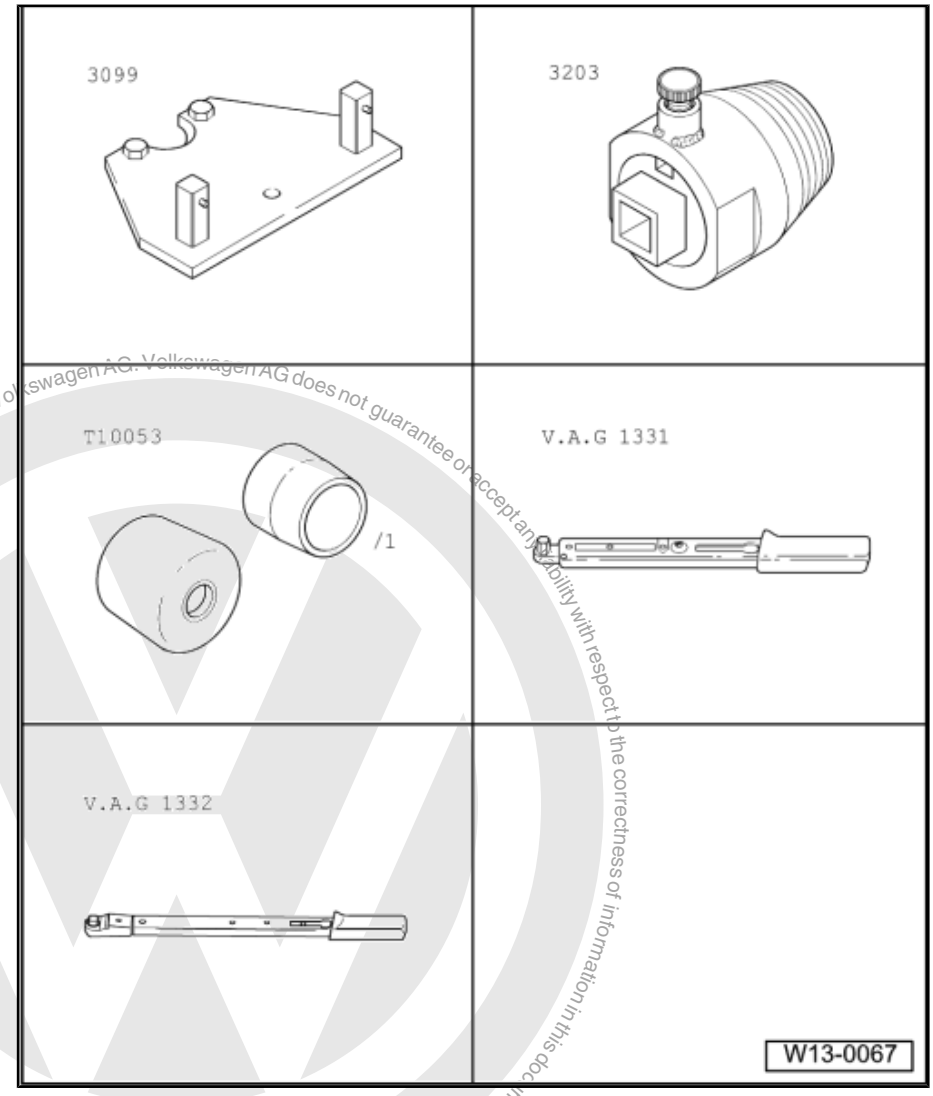
9 - Engine speed sender -G28-

- ❑ Loosen and tighten using commercially available ball-ended hex key socket.
- ❑ Tightening torque: 5 Nm

2.2 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ♦ Counter-hold tool -3099-
- ♦ Oil seal extractor -3203-
- ♦ Assembly device -T10053-
- ♦ Torque wrench - V.A.G 1331-
- ♦ Torque wrench - V.A.G 1332-



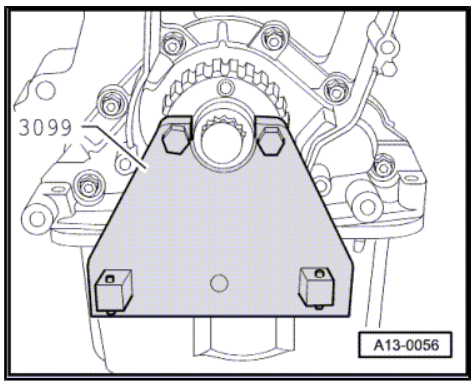
Removing ⇒ page 34

Installing ⇒ page 34

2.2.1 Removing

– Remove toothed belt ⇒ page 62 .

– Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counter-hold tool -3099- .



Note

When bolting on counter-hold tool, place two washers between toothed belt pulley and counter-hold tool.

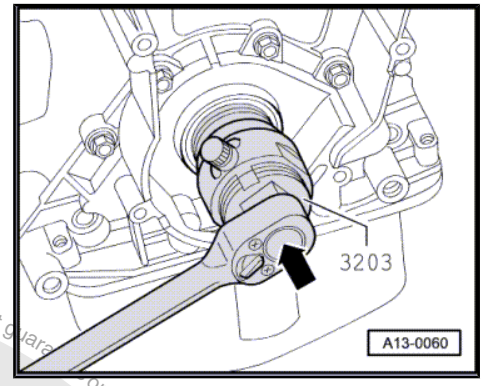
– To guide oil seal extractor -3203- , screw central bolt by hand fully into crankshaft.

– Unscrew inner part of oil seal extractor nine turns (approx. 17 mm) out of outer part and lock with knurled screw.

– Oil threaded head of oil seal extractor -3203- .

– Forcefully screw oil seal extractor as far as possible into seal.

– Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.



2.2.2 Installing

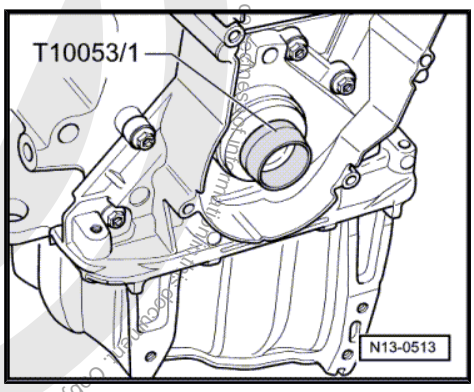
Note

The oil seal sealing lip must not be additionally oiled or greased.

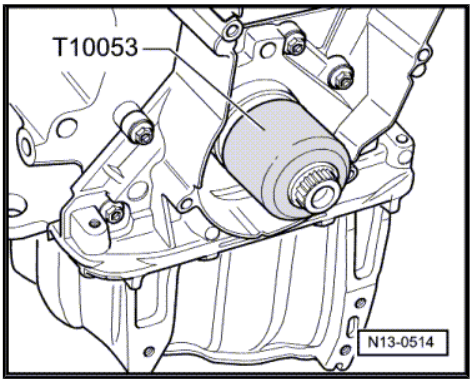
– Remove oil residue from crankshaft journal using a clean cloth.

– Fit guide sleeve -T10053/1 - onto crankshaft journal.

– Slide oil seal over guide sleeve onto crankshaft journal.



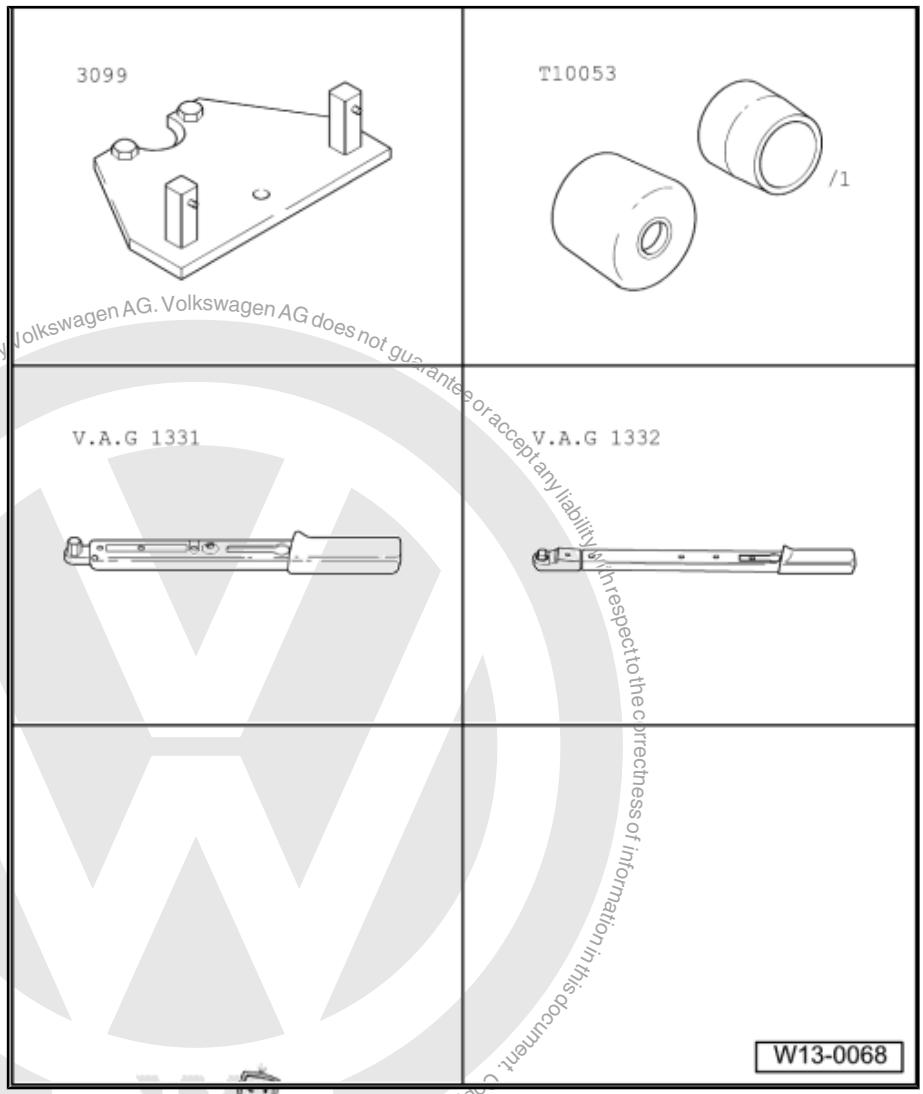
– Press seal with press sleeve -T10053- and central bolt to limit stop.
– Install crankshaft toothed belt pulley with new centre bolt.
– Install and tension toothed belt ⇒ page 62 .



2.3 Removing and installing sealing flange - pulley end

Special tools and workshop equipment required

- Counter-hold tool -3099-
- Assembly device -T10053-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-
- Hand drill with plastic brush attachment
- Flat scraper
- Eye protection
- Silicone sealant -D 176 404 A-



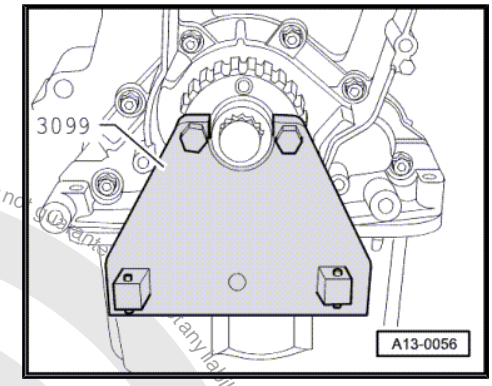
Removing ⇒ page 35

Installing ⇒ page 36

2.3.1 Removing

– Remove toothed belt ⇒ page 62 .

– Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counter-hold tool -3099- .



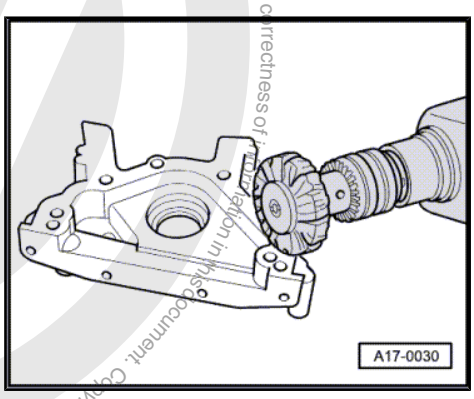
Note

When bolting on counter-hold tool, place two washers between toothed belt pulley and counter-hold tool.

– Drain engine oil.
– Remove sump ⇒ page 101 .
– Remove sealing flange -belt pulley end-.
– Remove sealing flange -belt pulley end-, release using light blows with a rubber headed hammer if necessary.

Drive out oil seal with sealing flange removed.

– Remove sealant residue on cylinder block with a flat scraper.
– Remove residual sealant from sealing flange using a plastic rotary brush (wear eye protection).
– Clean the sealing surfaces. The sealing surfaces must be free of oil and grease.

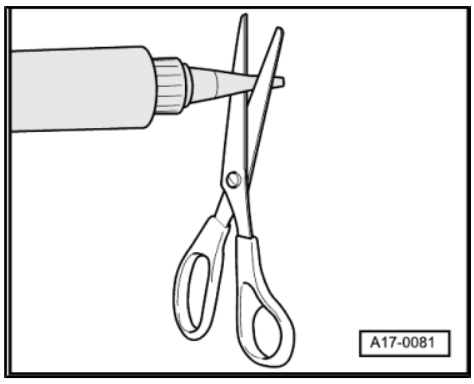


2.3.2 Installing

Note

- *Observe the use-by date of the sealing compound.*
- *Sealing flange must be installed within 5 minutes of applying silicone sealant.*

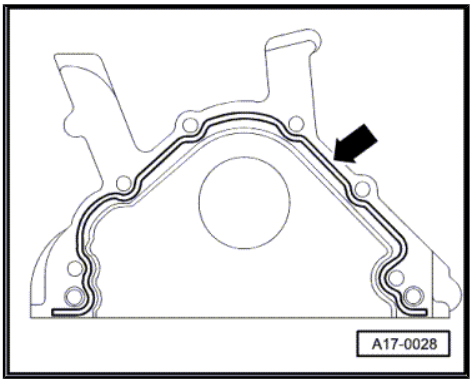
– Remove oil residue from crankshaft journal using a clean cloth.
– Cut off tube nozzle at forward marking (approx. 3 mm nozzle ∅).



Note

- *The sealing compound bead must not be thicker than 2...3 mm, otherwise excessive sealing compound will enter the sump and may block the suction pipe strainer of the oil pump, and can also drop on the sealing surface of the crankshaft sealing ring.*
- *Before applying sealant bead, cover sealing surface of oil seal with a clean cloth.*

– Apply silicone sealant bead -arrow-, as shown to the clean sealing surface of the sealing flange.
– Install sealing flange immediately and tighten all bolts lightly.



Note

When fitting sealing flange with oil seal installed, use guide sleeve -T10053/1- .

– Tighten securing bolts for sealing flange to 15 Nm using alternate and diagonal sequence.
– Install new oil seal ⇒ page 33 .
– Install sump ⇒ page 101 .

Note

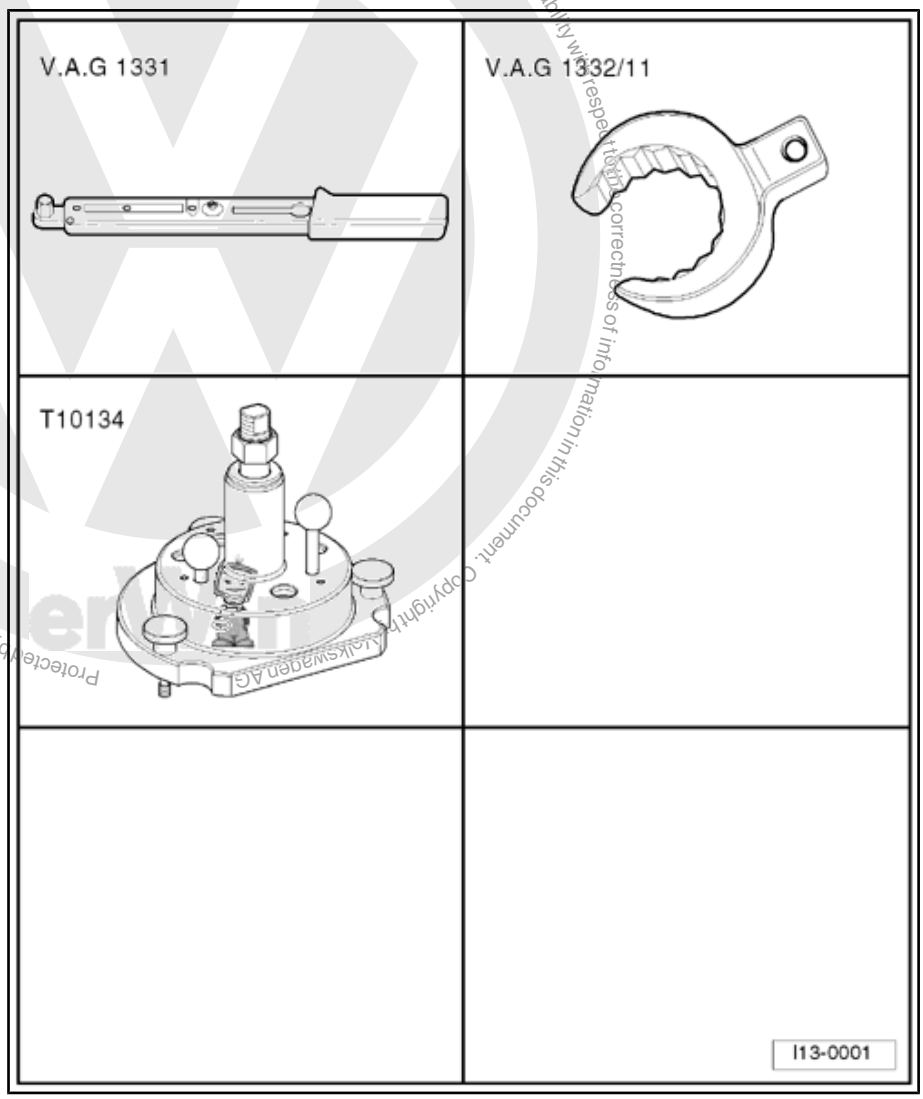
Sealing compound must dry for approx. 30 minutes after installation. Then (and only then) fill the engine with engine oil.

– Install and tension toothed belt ⇒ page 62 .

2.4 Renewing crankshaft sealing flange - flywheel end

Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-
- Tool insert 24 mm -V.A.G 1332/11-
- Assembly device -T10134-
- Vernier gauge
- Three hexagon bolts -M6 x 35 mm-
- Two hexagon bolts -M7 x 35 mm-



Pressing out sealing flange with sender wheel ⇒ page 39

Pressing in sealing flange with sender wheel ⇒ page 40

A - Fit assembling seal with sender wheel on assembly appliance - T10134- ⇒ page 40

B - Attaching assembling tool -T10134- with sealing flange to crankshaft flange ⇒ page 42

C - Bolting assembly tool -T10134- onto crankshaft flange ⇒ page 43

D - Pressing sender wheel onto crankshaft flange using assembly tool -T10134- ⇒ page 44

E - Checking sender wheel installation position on crankshaft ⇒ page 44

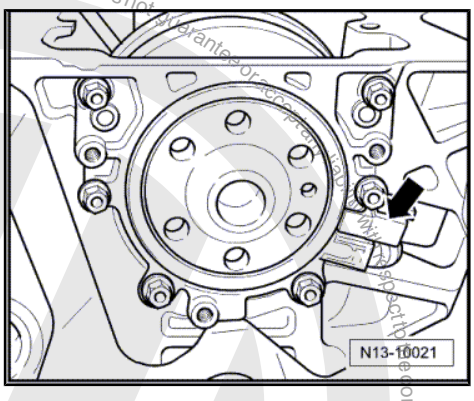
F - Re-pressing sender wheel ⇒ page 45

2.4.1 Pressing out sealing flange with sender wheel

Note

- *For the sake of clarity, the work is performed with the engine removed.*
- *The procedure is identical whether the engine is installed or removed.*

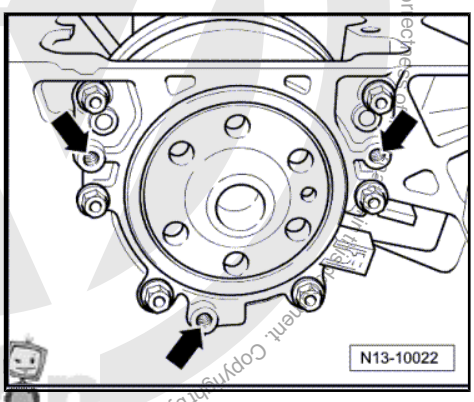
– Remove dual-mass flywheel ⇒ page 45
– Remove intermediate plate.
– Set the engine to TDC No. 1 cylinder ⇒ page 62
– Remove sump ⇒ page 101
– Remove engine speed sender -G28- -arrow- using a commercially available ball-ended hex key socket.
– Undo sealing flange securing bolts.



Note

Sealing flange and sender wheel are pressed off the crankshaft with hexagon bolts -M6 x 35 mm- .

– Screw three hexagon bolts -M6 x 35 mm- into the threaded holes arrows -arrows- of the sealing flange.
– Screw the bolts alternately (max. $^1/_2$ turn (180°) per bolt) into the sealing flange and press the sealing flange and the sender wheel off the crankshaft.



2.4.2 Pressing in sealing flange with sender wheel

Note

- *The sealing flange with a PTFE seal is equipped with a sealing lip support ring. This support ring serves as a fitting sleeve and must not be removed prior to installation.*
- *Sealing flange and sender wheel must not be separated or turned after removal from packaging.*
- *The sender wheel is held in its installation position on the assembly device -T10134- by a locating pin.*
- *Sealing flange and seal are one unit and must be replaced together with the sender wheel only.*
- *The assembly device -T10134- is held in its position relative to the crankshaft by a guide pin inserted into a hole in the crankshaft.*

Assembly device -T10134-

A - Clamping surface

B - Hexagon nut

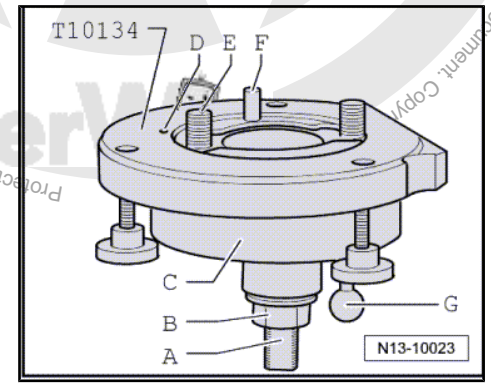
C - Assembly housing

D - Locating pin

E - Hexagon socket head bolt

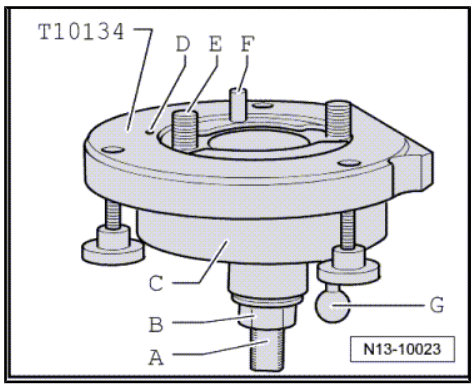
F - Guide pin for diesel engines (black knob)

G - Guide pin for petrol engines (red knob)

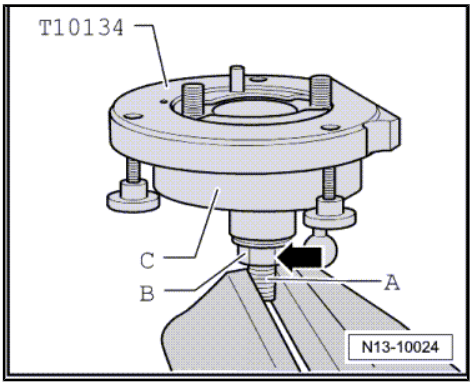


2.4.3 A - Fit assembling seal with sender wheel on assembly appliance -T10134-

– Screw in hexagon nut -B- to just before clamping surface -A- of threaded spindle.



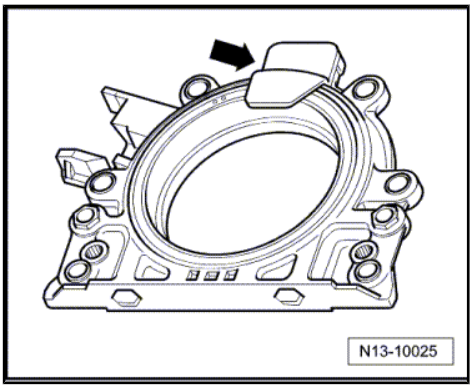
– Clamp assembly device -T10134- in a vice on clamping surface -A- of threaded spindle.
– Press assembly hub -C- downwards so that it lies on hexagon nut -B- -arrow-.



Note

Inner part of assembly tool and assembly housing must be at same height.

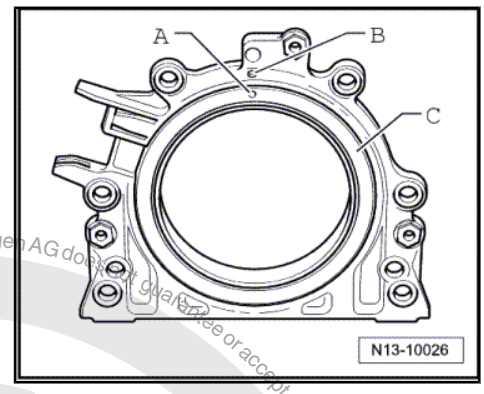
– Remove securing clip -arrow- from new sealing flange.



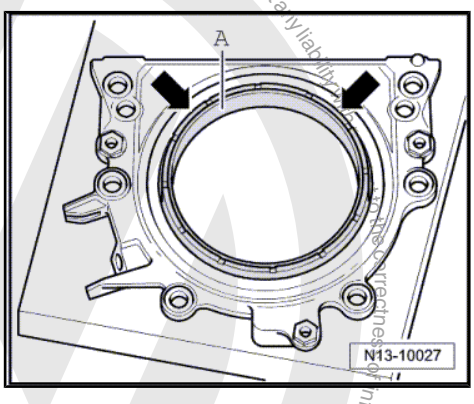
Note

The sender wheel must not be taken out of the sealing flange or turned.

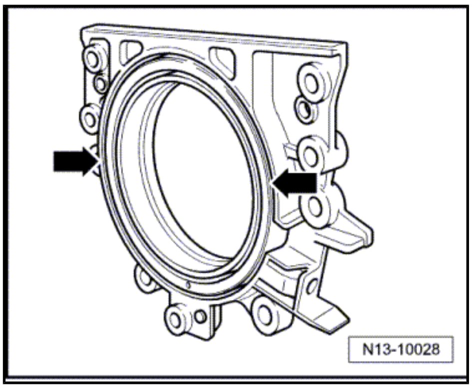
– Locating hole -A- on sender wheel -C- must align with marking -B- on sealing flange.
– Place sealing flange with front side downwards on a clean flat surface.



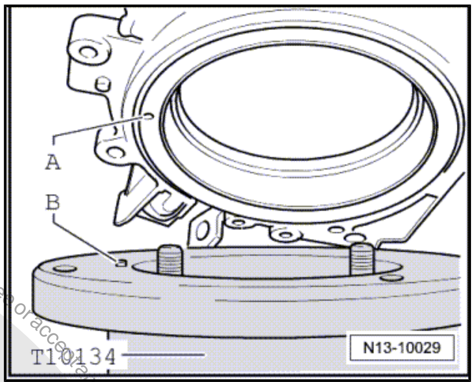
– Push sealing lip support ring -A- downwards in -direction of arrow- until it lies on flat surface.



– Upper edge of sender wheel and front edge of sealing flange must align -arrows-.



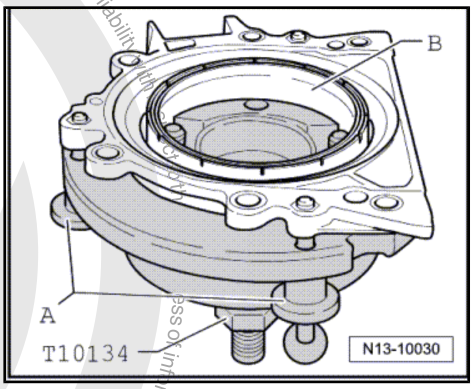
– Place sealing flange with front side on assembly device -T10134- so that locating pin -B- can be inserted in sender wheel hole -A-.



Note

Ensure sealing flange lies flat on assembly tool.

– Push sealing flange and support ring for sealing lip -B- against surface of assembly device - T10134- whilst tightening the three knurled screws -A- so that locating pin cannot slide out of sender wheel hole.



Note

When installing sealing flange, ensure that sender wheel remains fixed in assembly device.

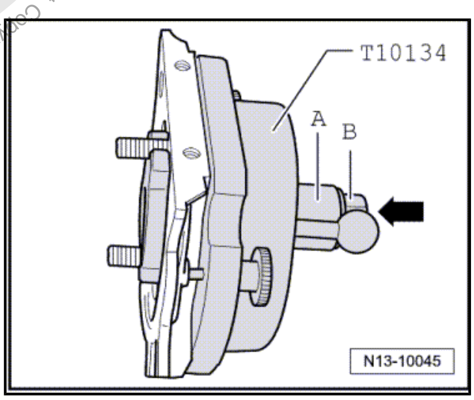
2.4.4 B - Attaching assembling tool -T10134- with sealing flange to crankshaft flange

- Crankshaft flange must be free of oil and grease.
- Engine positioned at TDC No. 1 cylinder

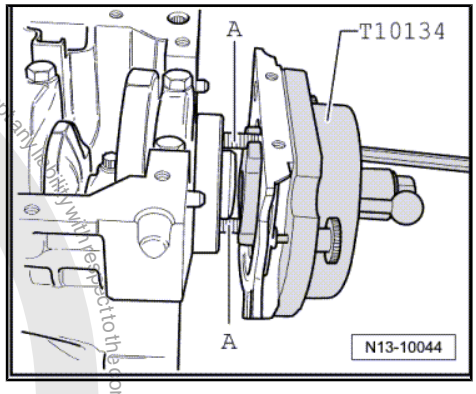
– Screw hexagon nut -B- to end of threaded spindle.

– Press threaded spindle of assembly tool -T10134- in -direction of arrow-, until hexagon nut -B- lies against assembly bell housing -A-.

– Align flat side of assembly housing on sump side of crankcase sealing surface.



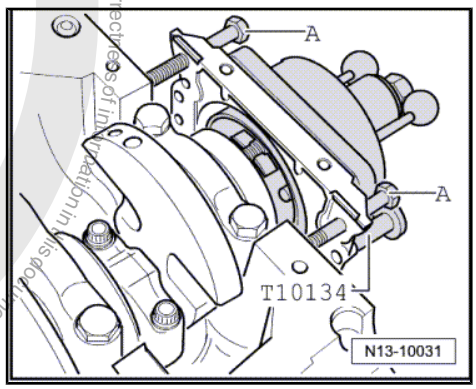
– Secure assembly tool -T10134 - to crankshaft flange using hexagon socket head bolts -A-.



Note

Screw hexagon socket head bolts -A- into crankshaft flange (approx. 5 full turns).

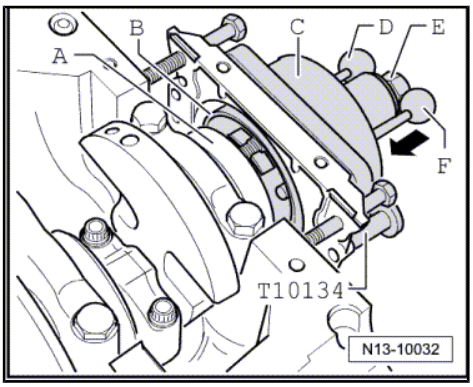
– To guide sealing flange, screw two hexagon bolts -M7 x 35 mm- -A- into the cylinder block.



2.4.5 C - Bolting assembly tool -T10134- onto crankshaft flange

– Push assembly bell housing -C- by hand in -direction of arrow- until sealing lip support ring -B- contacts crankshaft -A-.

– Push guide pin for diesel engines (black knob) -D- into hole in crankshaft. This ensures that the sender wheel reaches its final installation position.



Note

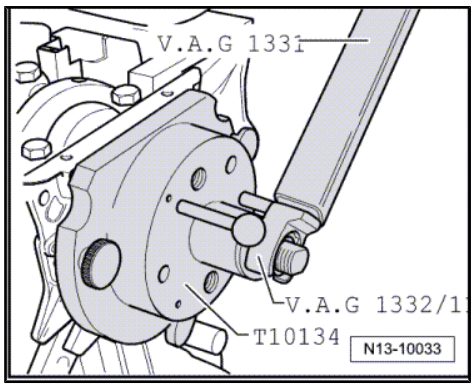
The guide pin for petrol engines (red knob) -F- must not be inserted in threaded hole of crankshaft.

– Hand tighten both hexagon socket head bolts of assembly tool.

– Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly bell housing -C-.

2.4.6 D - Pressing sender wheel onto crankshaft flange using assembly tool - T10134-

– Tighten hexagon nut of assembly tool -T10134- to 35 Nm using torque wrench -V.A.G 1331- and insert -V.A.G 1332/11- .

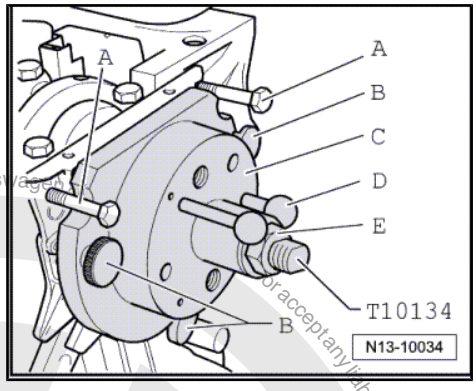


Note

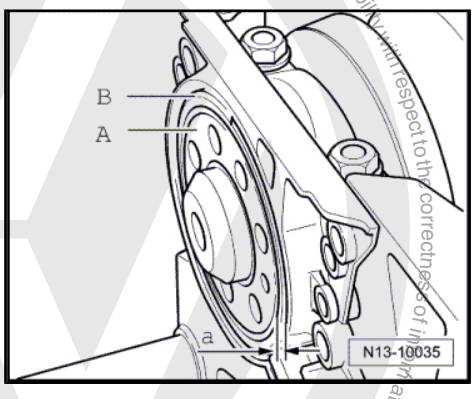
After hexagon nut is tightened to 35 Nm torque, a small air gap must be present between cylinder block and sealing flange.

2.4.7 E - Checking sender wheel installation position on crankshaft

– Screw hexagon nut -E- to end of threaded spindle.
– Remove the two bolts -A- from cylinder block.
– Screw the three knurled screws -B- out of sealing flange.
– Remove assembly tool -T10134- .
– Remove sealing lip support ring.



– The sender wheel is in the correct installation position on the crankshaft if a gap -a- = 0.5 mm exists between crankshaft flange -A- and sender wheel -B-.
– Set vernier gauge on crankshaft flange.



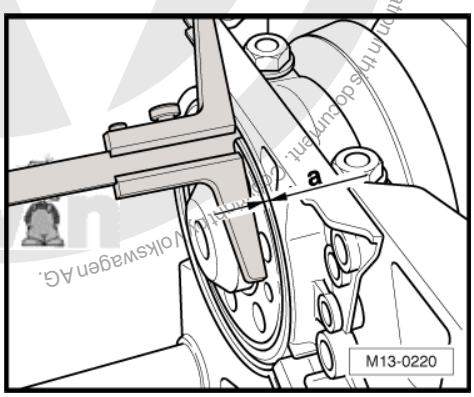
– Measure distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

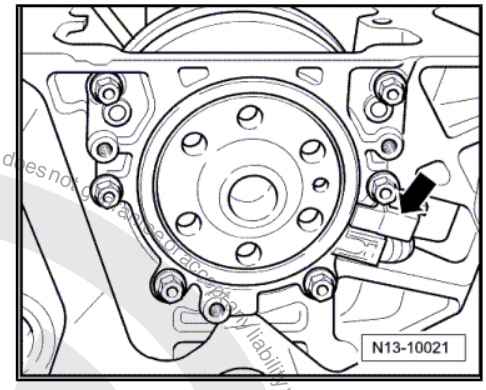
– Re-press sender wheel ⇒ page 45 .

If dimension -a- is achieved:

– Tighten new securing bolts for sealing flange to 15 Nm using alternate and diagonal sequence.

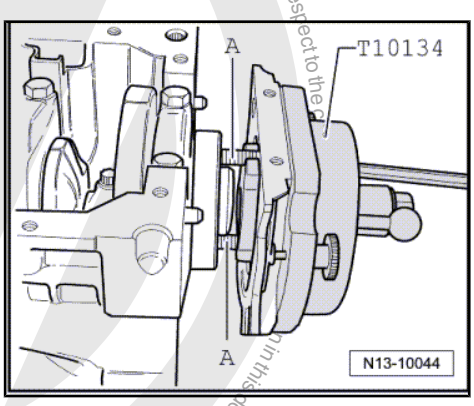


– Install engine speed sender -G28- -arrow- and tighten securing bolt to 5 Nm.
– Install sump ⇒ page 101 .
– Install intermediate plate.
– Install flywheel using new bolts. Tighten securing bolt to 60 Nm + 90° (1/4 turn).

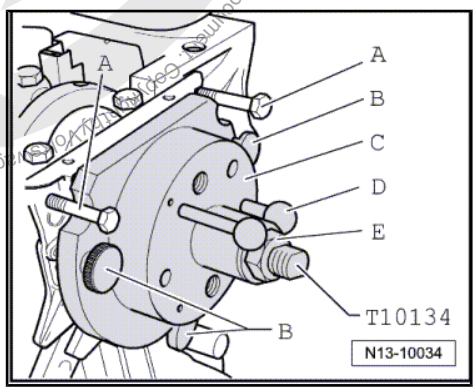


2.4.8 F - Re-pressing sender wheel

– Secure assembly tool -T10134 - to crankshaft flange using hexagon socket head bolts -A-.
– Hand tighten both hexagon socket head bolts.
– Push assembly tool -T10134- by hand to sealing flange.



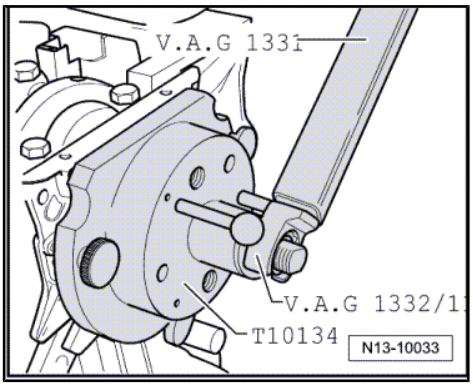
– Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly bell housing -C-.



– Tighten hexagon nut of assembly tool -T10134- to 40 Nm using torque wrench -V.A.G 1331 - and insert -V.A.G 1332/11- .
– Check installation position of sender wheel on crankshaft again ⇒ page 44 .

If dimension “a” is too small again:

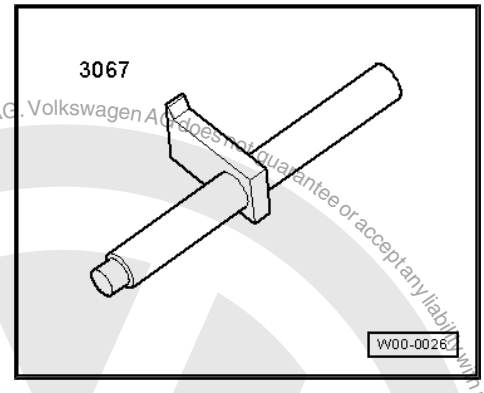
– Tighten hexagon nut for assembly tool -T10134- to 45 Nm.
– Check installation position of sender wheel on crankshaft again ⇒ page 44 .



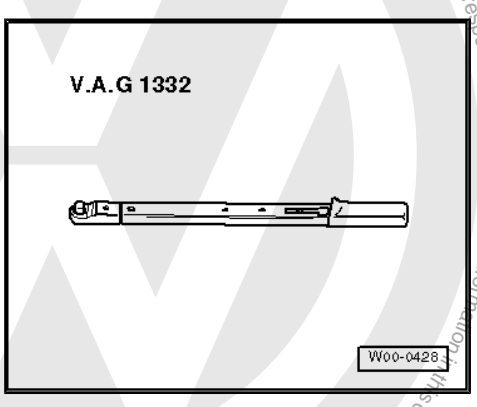
2.5 Removing and installing dual-mass flywheel

Special tools and workshop equipment required

♦ Counter-hold tool -3067-



♦ Torque wrench -V.A.G 1332-



Removing ⇒ page 46
Installing ⇒ page 47

2.5.1 Removing

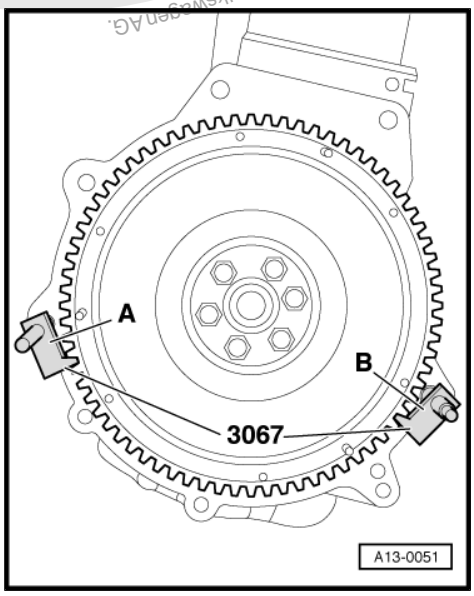
– Fit counter-hold -3067- into the hole of the cylinder head.

• Position of counter-hold tool:

A - To tighten

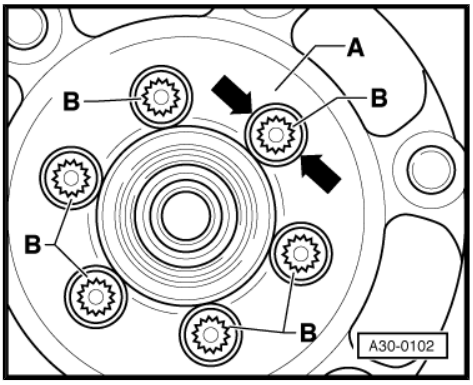
B - To loosen

– Mark installation position of dual-mass flywheel on engine.



Note

To avoid damaging the dual-mass flywheel during removal, the bolts -B- must not be removed using a pneumatic or impact driver. The bolts may only be removed by hand using conventional tools.



- Rotate the dual-mass flywheel -A- so that the bolts align with the holes -arrows-.
- When unscrewing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel; the flywheel will otherwise be damaged as the bolts are screwed out.

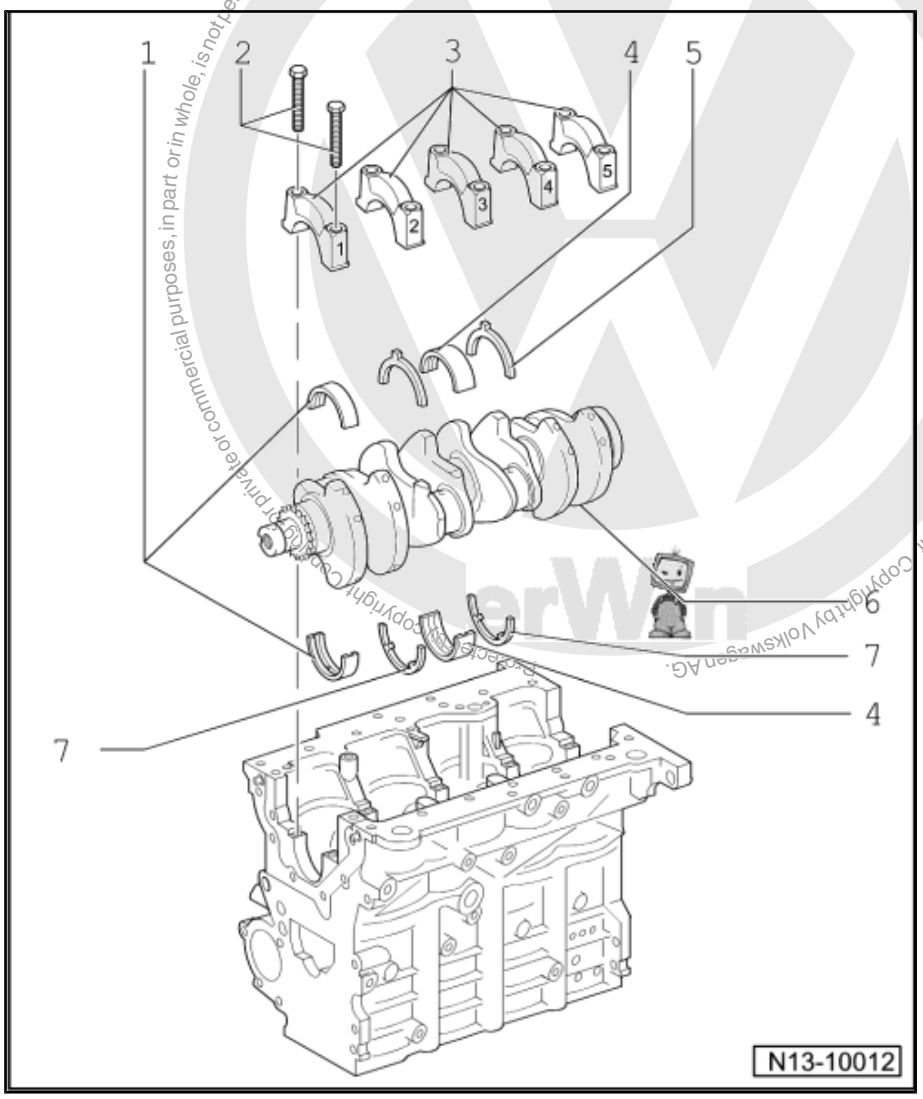
2.5.2 Installing

Install in reverse order. In the process, note the following:

- Use new bolts for securing.
- Tighten bolts to 60 Nm + 90° (1/4 turn).

3 Crankshaft

3.1 Assembly overview - crankshaft



1 - Bearing shells 1, 2, 4 and 5

- ❑ For bearing cap without oil groove
- ❑ For cylinder block with oil groove
- ❑ Do not interchange used bearing shells (mark)

2 - 65 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ To measure radial clearance, tighten to 65 Nm but not further.

3 - Bearing cap

- ❑ Bearing cap 1: Pulley end.
- ❑ Bearing cap 3 with recesses for thrust washers.
- ❑ Bearing shell retaining lugs in cylinder block and bearing caps must be above one another.

4 - Bearing shell 3

- ❑ For bearing cap without oil groove
- ❑ For cylinder block with oil groove

5 - Thrust washer

- ❑ For bearing cap 3
- ❑ Note fixing arrangement

6 - Crankshaft

- ❑ Axial clearance new: 0.07...00.17 mm, wear limit: 0.37 mm
- ❑ Check radial clearance with Plastigage new: 0.03...00.08 mm, wear limit: 0.17 mm.
- ❑ Do not rotate crankshaft when checking radial clearance
- ❑ Crankshaft dimensions ⇒ page 49 .

7 - Thrust washer

- ❑ For cylinder block, bearing 3

3.2 Crankshaft dimensions

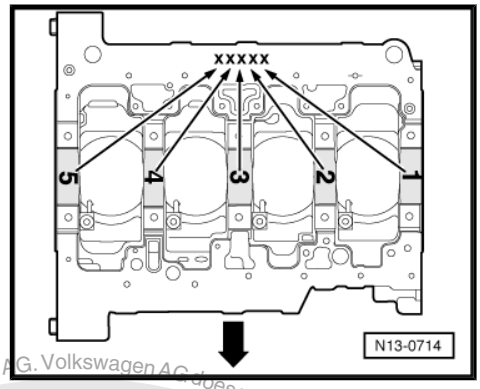
(Dimensions in mm)

Honing dimension	Crankshaft main journal ∅	Conrod journal ∅
Basic dimension	54.00 -0.022 -0.042	47.80 -0.022 -0.042

3.3 Identification of upper crankshaft bearing

Upper bearing shells with the correct thickness are allocated to the cylinder block in the factory. Coloured spots serve to identify the thickness of the bearing shells.

Letter codes on the lower sealing surface of the cylinder block indicate the thickness of the bearing shell to be fitted at each location.



G	=	Yellow
B	=	Blue
W	=	White

Note

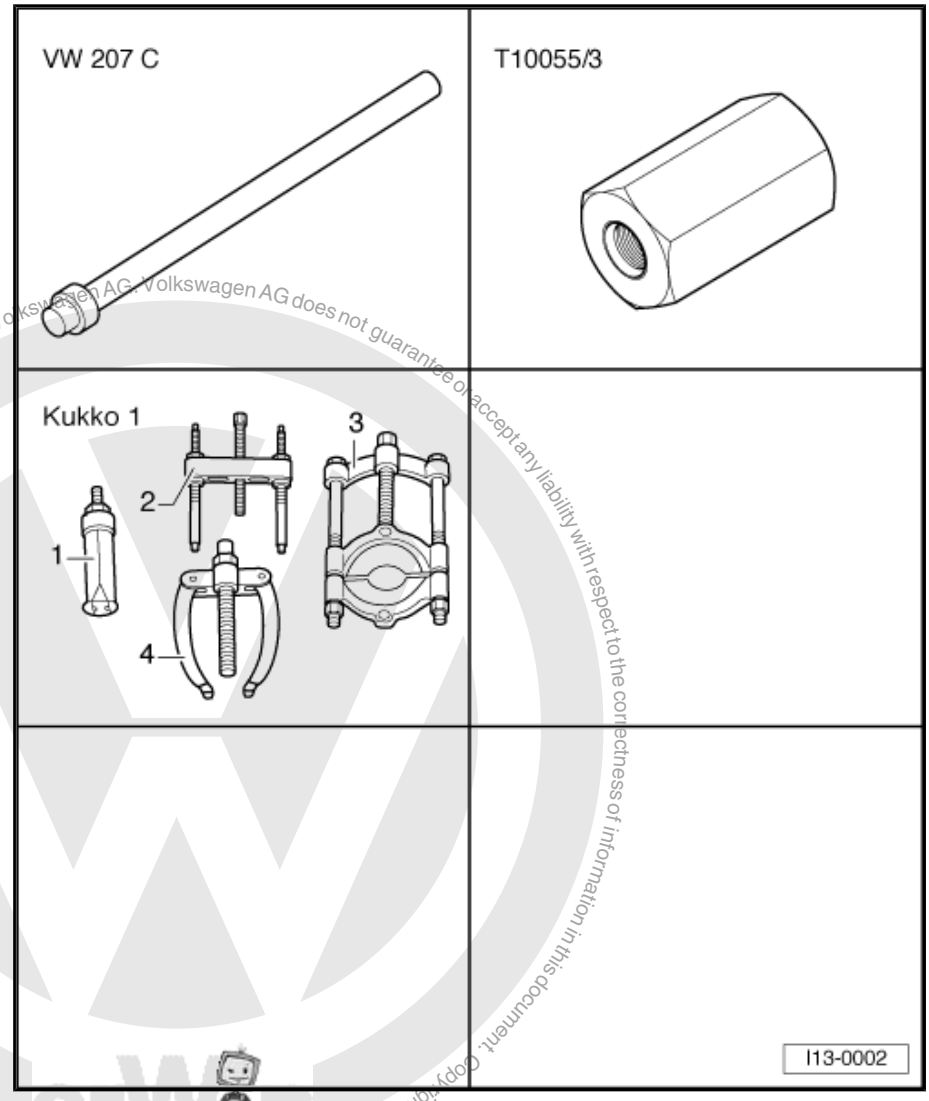
- *Arrow points in direction of travel.*
- *If the coloured marks are no longer legible, use blue bearing shells.*
- *Crankshaft lower bearing shells with "yellow" colour mark are always supplied as spare parts.*

3.4 Pulling needle bearing out of and driving into crankshaft

Vehicles with direct shift gearbox only

Special tools and workshop equipment required

- Drift -VW 207 C-
- or centring mandrel -3176-
- Puller -T10055- with adapter -T10055/3-
- 1 Internal puller -Kukko 21/2-

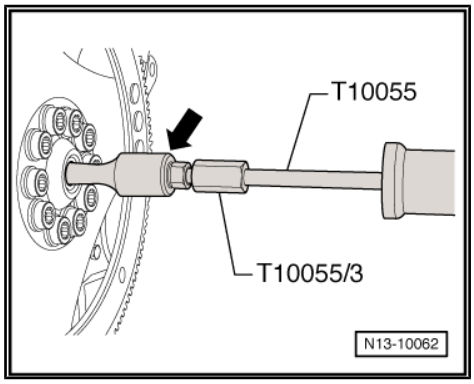


Note

In vehicles with direct shift gearbox the needle bearing must be mounted on the rear of the crankshaft.

Removing

– Remove needle bearing with internal puller -Kukko 21/2- -arrow-, adapter -T10055/3- and puller -T10055- .

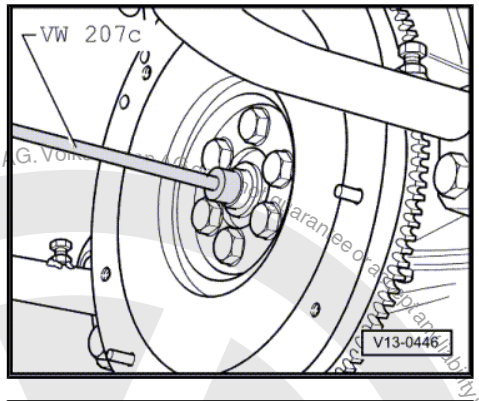


Installing

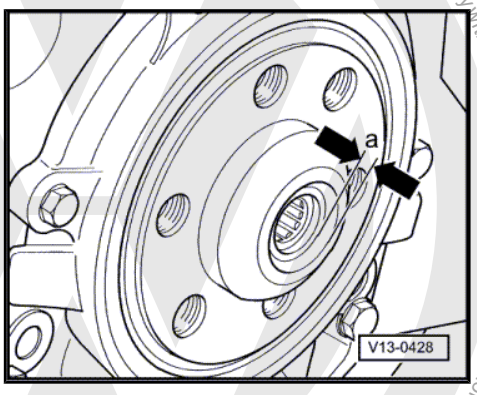
Note

The lettering on the needle bearing must be visible when installed.

– Drive in using drift -VW 207 C- or centring mandrel -3176- .

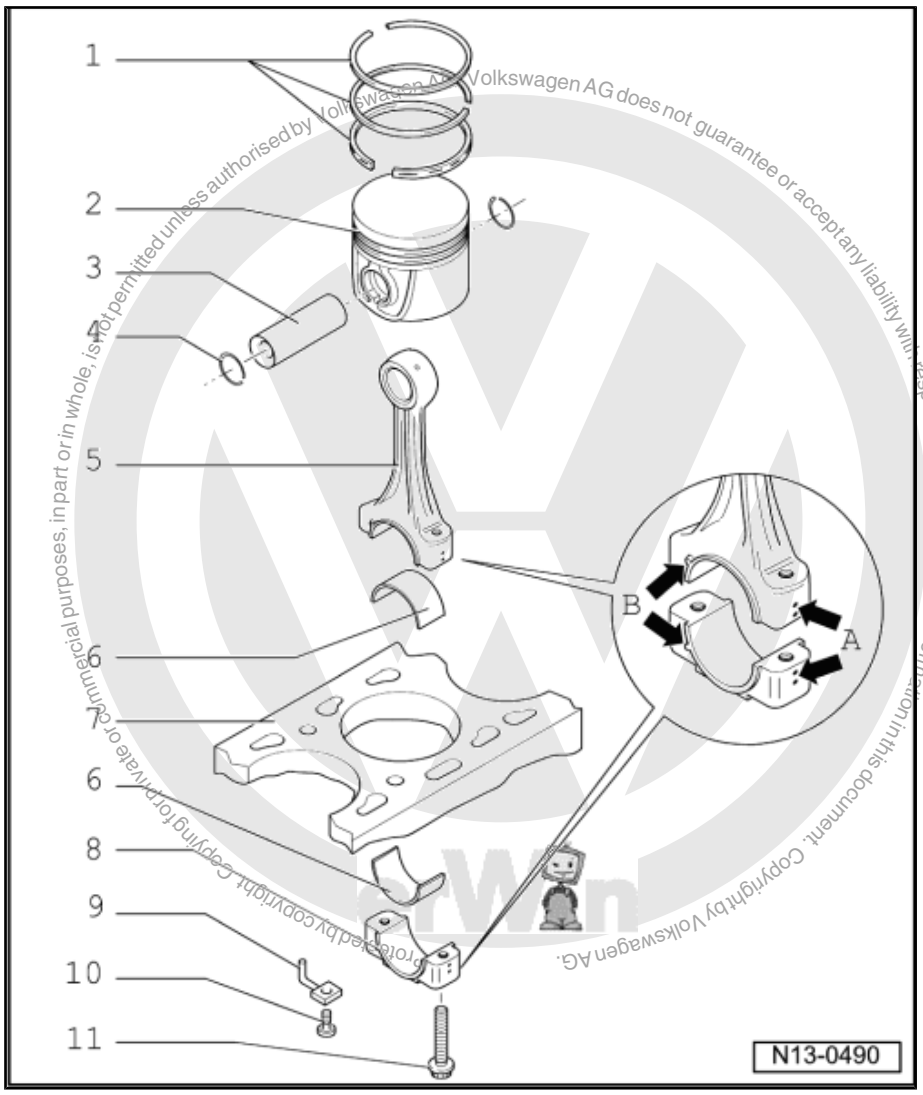


Installation depth: dimension -a- = 2 mm.



4 Pistons and connecting rods

4.1 Assembly overview - pistons and conrods



1 - Piston rings

- ❑ Offset gaps by 120°
- ❑ Remove and install using piston ring pliers
- ❑ “TOP” faces towards piston crown.
- ❑ Checking ring gap ⇒ page 54
- ❑ Checking ring-to-groove clearance ⇒ page 55

2 - Piston

- ❑ With combustion chamber.
- ❑ Mark installation position and cylinder number.
- ❑ Installation position and allocation of piston to cylinder ⇒ page 56
- ❑ Arrow on piston crown points to pulley end.
- ❑ Install using piston ring clamp.
- ❑ If piston skirt is cracked, renew piston.
- ❑ Checking piston projection at TDC ⇒ page 53

3 - Piston pin

- ❑ If difficult to remove, heat piston to 60°C.
- ❑ Remove and install with drift -VW 222 A-

4 - Circlip

5 - Conrod

- ❑ Mark cylinder number -arrows A- with coloured pen
- ❑ Installation position: Marking -arrows B- faces towards pulley end.
- ❑ With industrially cracked conrod bearing cap

6 - Ball socket

- ❑ Note installation position.
- ❑ Note type: upper bearing shell (closest to piston) is constructed from more wear-resistant material. Identification: Black line on bearing surface in area of joint
- ❑ Do not interchange used bearing shells

- ❑ Insert bearing shells centrally.
- ❑ Check for secure seating.
- ❑ Axial clearance: wear limit: 0.37 mm
- ❑ Check radial clearance with Plastigage: Wear limit: 0.08 mm, do not rotate crankshaft when checking radial clearance.

7 - Cylinder block

- ❑ Checking cylinder bores ⇒ page 55
- ❑ Piston and cylinder dimensions ⇒ page 54 .

8 - Conrod bearing cap

- ❑ Note installation position.
- ❑ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod.

9 - Oil spray jet

- ❑ For piston cooling

Note

10 - 25 Nm

- ❑ Insert without sealant.

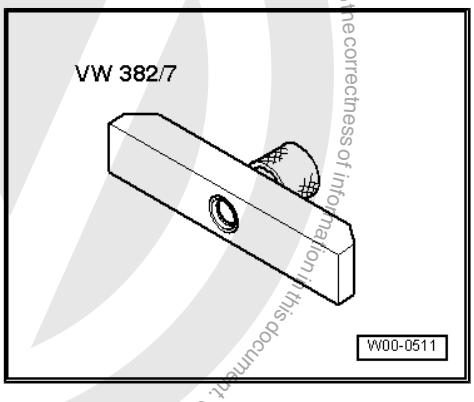
11 - Conrod bolt, 30 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ Oil threads and contact surface.
- ❑ Use old bolt for measuring radial clearance

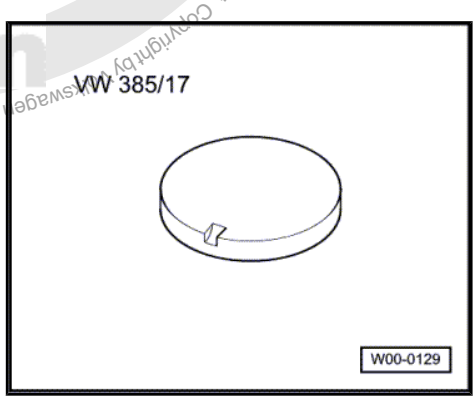
4.2 Checking piston projection at TDC

Special tools and workshop equipment required

- ♦ Measuring bridge -VW 382/7-

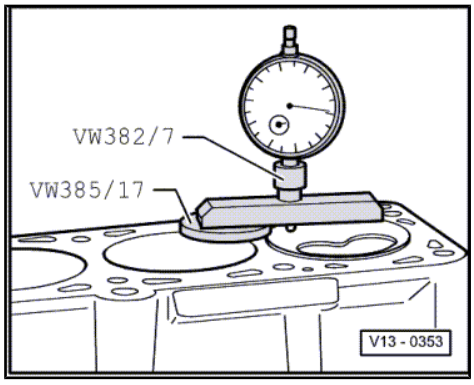


- ♦ End dimension plate -VW 385/17-



- ♦ Dial gauge

Test procedure



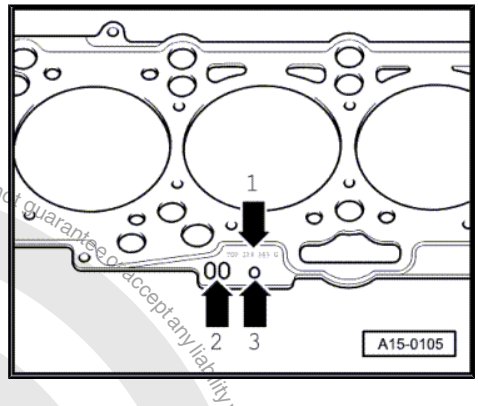
Note

- *If different values are determined during the projection measurement, use the largest dimension for selecting the gasket.*
- *Turn engine clockwise to measure piston projection at TDC.*

Piston projection at TDC must be measured when installing new pistons or a short engine. Install the appropriate cylinder head gasket depending upon piston projection, according to following table:

Piston projection	Identification Holes/notches
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3

Cylinder head gasket identification



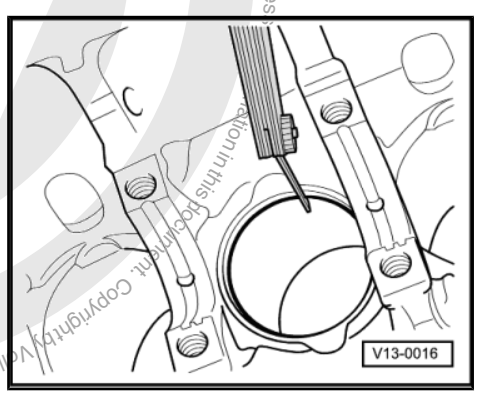
- Part No = -arrow 1-
- Production control code = -arrow 2- (disregard)
- Holes = -arrow 3-

4.3 Piston and cylinder dimensions

Honing dimension		Piston ∅	Cylinder bore ∅
Basic dimension	mm	79.47	79.51
1st oversize	mm	79.72	79.76
Stage II	mm	79.97	80.01

4.4 Piston rings, cylinder bore and piston installation position

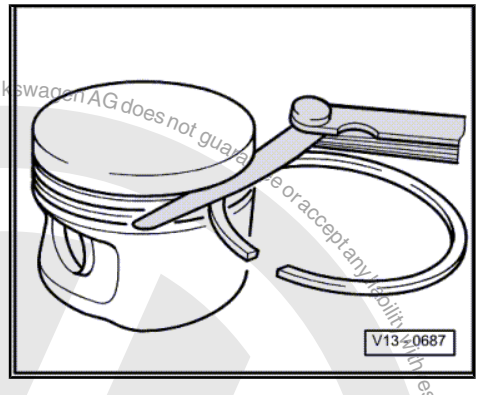
Checking piston ring gap



Special tools and workshop equipment required

- Feeler gauges

– Push piston ring squarely from above down to approx. 15 mm from bottom end of cylinder.



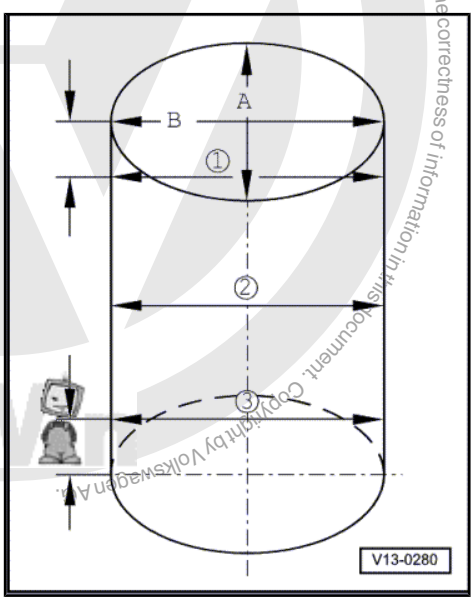
Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.20...0.40	1.0
2nd compression ring	0.20...0.40	1.0
Oil scraper ring	0.25...0.50	1.0

Checking ring-to-groove clearance

Special tools and workshop equipment required

♦ Feeler gauges

– Clean groove in piston before checking clearance.



Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06...0.09	0.25
2nd compression ring	0.05...0.08	0.25
Oil scraper ring	0.03...0.06	0.15

Checking cylinder bores

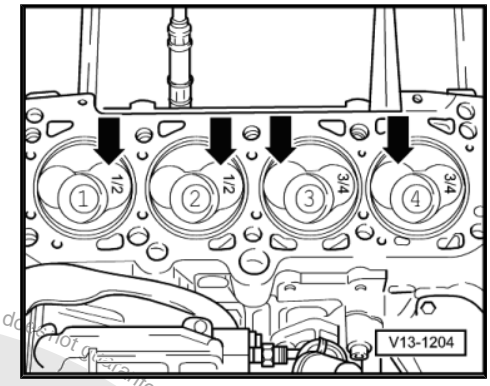
Special tools and workshop equipment required

♦ Cylinder gauge 50...100 mm

– Take measurements at 3 positions in both transverse -A- and longitudinal -B- directions, as illustrated. Difference between actual and nominal diameter: not more than 0.10 mm.

Note

Measuring the cylinder bores must not be done when the cylinder block is mounted on a repair stand with adapter bracket -VW 540 - , as incorrect measurements would then be possible.



Piston installation position and allocation of piston to cylinder

Piston in cylinders 1 and 2:

Larger inlet valve recess -arrows- towards flywheel.

Piston in cylinders 3 and 4:

Larger inlet valve recess -arrows- towards belt pulley end.

Note

- *New piston allocation to cylinders is shown by a coloured mark stamped on piston crown.*
- *Piston for cylinders 1 and 2: marked 1/2*
- *Piston for cylinders 3 and 4: marked 3/4*

15 – Cylinder head, valve gear

1 Cylinder head

Note

- *When installing an exchange cylinder head with fitted camshaft, the contact surfaces between the bucket tappets and the cam must be oiled before installing the cylinder head cover.*
- *The plastic protectors fitted to protect the open valves must not be removed until immediately before fitting the cylinder head.*
- *If the cylinder head is renewed, all the coolant in the system must also be renewed.*
- *Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.*
- *Do not rework valve seats. Only lapping in of valves is permitted.*
- *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic compensation elements must settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*
- *Always renew gaskets and seals.*

Cylinder head cover - Assembly overview ⇒ page 58

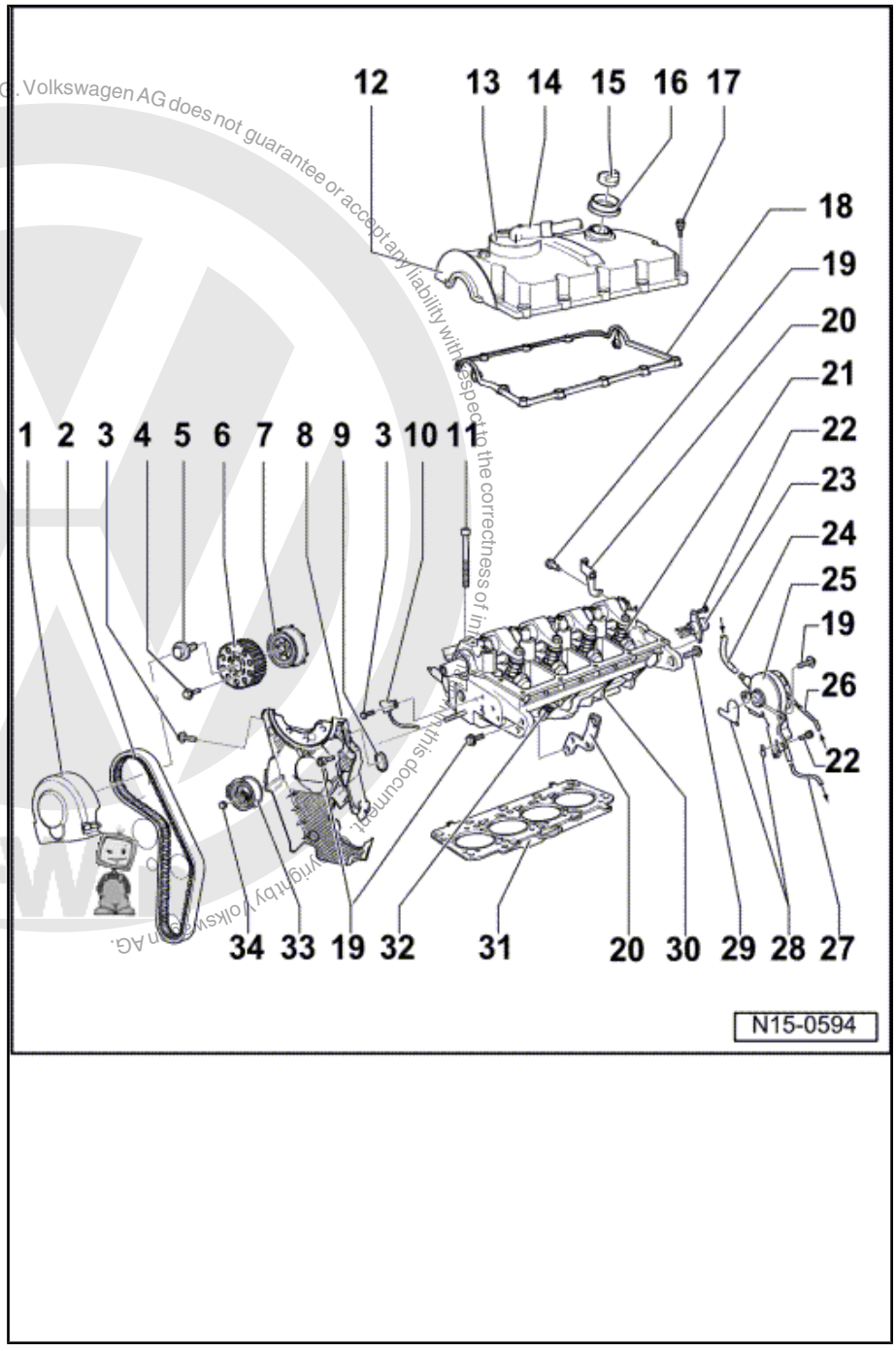
Removing and installing cylinder head cover ⇒ page 61

Removing, installing and tensioning toothed belts ⇒ page 62

Removing and installing cylinder head ⇒ page 79

Checking compression ⇒ page 83

1.1 Assembly overview - cylinder head



1 - Toothed belt guard upper part

2 - Toothed belt

- ❑ Mark direction of rotation before removing.
- ❑ Check for wear.
- ❑ Do not kink.
- ❑ Removing, installing and tensioning ⇒ page 62 .

3 - 10 Nm

- ❑ Renew.

4 - 25 Nm

5 - 100 Nm

6 - Camshaft pulley

7 - Hub

- ❑ With sender wheel.
- ❑ Use counter-hold - T10051 - to loosen and tighten
- ❑ To remove, use puller - T10052- .
- ❑ Removing and installing ⇒ page 92 .

8 - Rear toothed belt guard

9 - Sealing grommet

- ❑ Renew if damaged.

10 - Hall sender -G40-

- ❑ For camshaft position
- ❑ To remove sealing grommet ⇒ Item 9 (page 58) , unbutton from toothed belt guard.

11 - Cylinder head bolt

- ❑ Note sequence for loosening and tightening ⇒ page 79
- ❑ Before installing, place washers in cylinder head ⇒ Item 4 (page 87) .

12 - Cylinder head cover

- ❑ Before fitting, thoroughly clean sealing surface of cylinder head with clean cloth.

13 - Pressure regulating valve
- ❑ For crankcase breather.

14 - To turbocharger

15 - Cap
- ❑ Renew seal if damaged.

16 - Seal
- ❑ Renew if damaged.

17 - 10 Nm
- ❑ Observe tightening sequence ⇒ page 61

18 - Cylinder head cover gasket
- ❑ Renew together with cylinder head cover only.
- ❑ Seal with sealant, black -AMV 174 004 01- for gearbox housing before fitting ⇒ page 61

19 - 20 Nm

20 - Lifting eye

21 - Unit injector
- ❑ Removing and installing ⇒ page 219 .

22 - 10 Nm

23 - Central connector
- ❑ For unit injector.

24 - From brake servo

25 - Tandem pump
- ❑ For fuel and vacuum supply.
- ❑ Checking ⇒ page 160 .
- ❑ Removing and installing ⇒ page 166 .
- ❑ Must not be dismantled

26 - Supply hose
- ❑ From fuel filter ⇒ page 158 .
- ❑ White or with white marking.
- ❑ Check for secure seating.
- ❑ Secure with spring-type clips

27 - Return hose
- ❑ To fuel filter ⇒ page 158 .
- ❑ Blue or with blue marking
- ❑ Check for secure seating.
- ❑ Secure with spring-type clips

28 - Seal
- ❑ Renew.

29 - Bolt/screw

30 - Cylinder head
- ❑ Removing and installing ⇒ page 79 .
- ❑ If renewed, change coolant in entire system.

31 - Cylinder head gasket
- ❑ Renew.
- ❑ Note marking ⇒ page 60
- ❑ If renewed, change coolant in entire system.

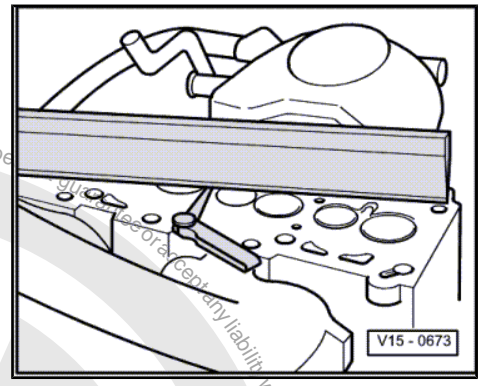
32 - Glow plug/ceramic glow plug

- ❑ 15 Nm
- ❑ Installation instructions and notes should be strictly adhered to ⇒ page 274
- ❑ Checking ⇒ page 274 .

33 - Tensioning roller

34 - 20 Nm +45° (1/8 turn) further

Checking cylinder head for distortion



Special tools and workshop equipment required

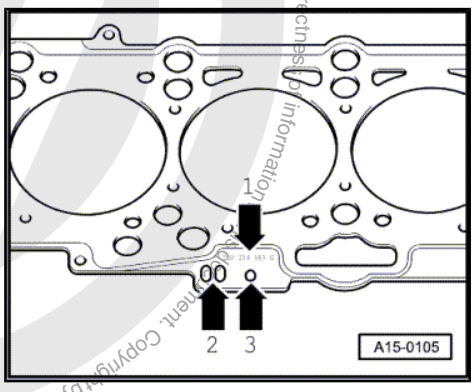
- ♦ Straight edge
- ♦ Feeler gauges

Max. permissible distortion: 0.05 mm.

Note

Reworking diesel cylinder heads is not permissible.

Cylinder head gasket identification

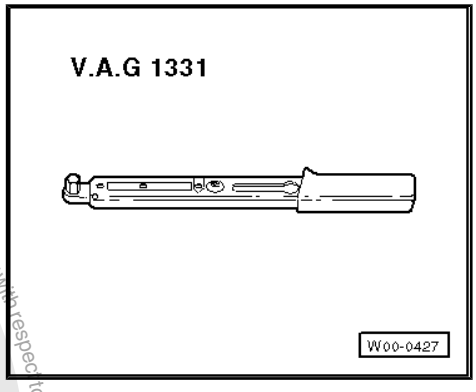


- ♦ Part No = -arrow 1-
- ♦ Production control code = -arrow 2- (disregard)
- ♦ Holes = -arrow 3-

Note

- ♦ *Different thicknesses of cylinder head gasket are fitted depending on the piston projection. When fitting a new cylinder head gasket, install a new gasket with same identification.*
- ♦ *Piston projection at TDC must be determined when installing new pistons or overhauled engine ⇒ page 53 .*

1.2 Removing and installing cylinder head cover

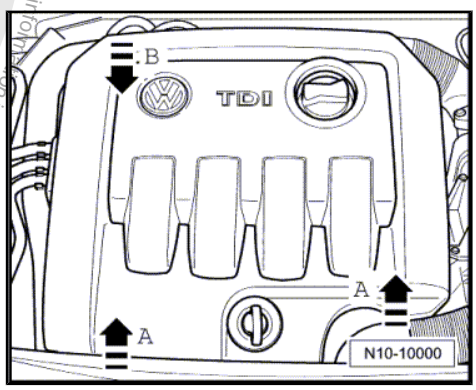


Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Sealant, black -AMV 174 004 01-

Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



– Remove upper toothed belt guard.

– Pull crankcase breather hoses off cylinder head cover.

– Unbolt bracket from exhaust gas recirculation valve.

– Remove cylinder head cover.

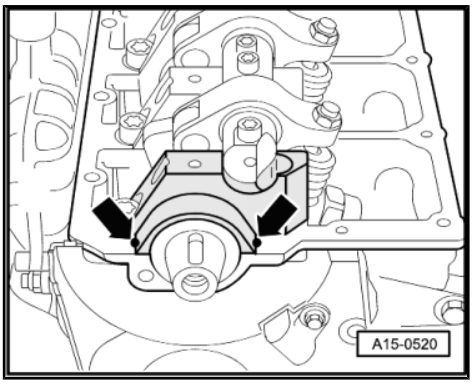
Installing

Install in reverse order. In the process, note the following:

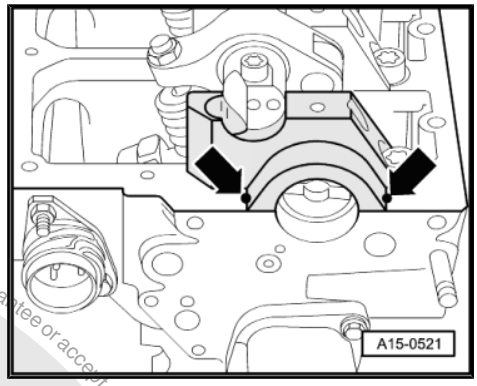
Note

Renew seal for bolts if damaged.

– Apply a drop of sealant, black -AMV 174 004 01- (∅ approx. 5 mm) to both forward edges of bearing cap/cylinder head sealing surface -arrows-.

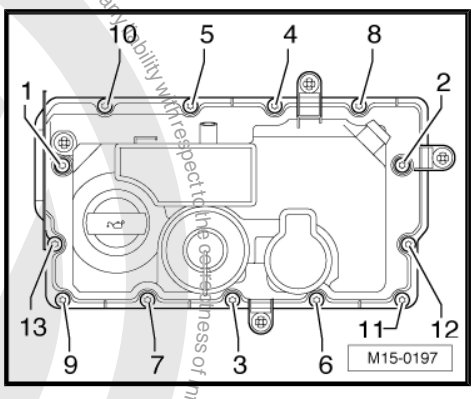


– Apply a drop of sealant, black -AMV 174 004 01- (∅ approx. 5 mm) to both rear edges of bearing cap/cylinder head sealing surface -arrows-.



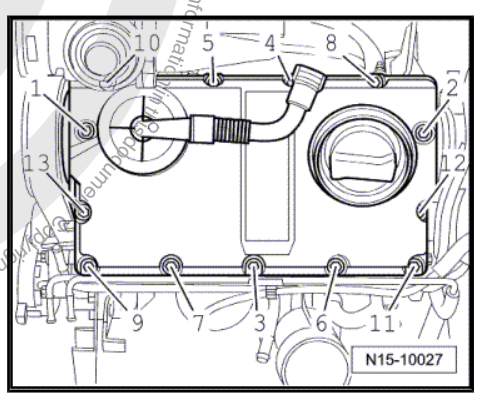
Engine codes BRM, BLS

– Tighten bolts of the cylinder head cover hand tight in the sequence -1…13-.
– Tighten the bolts in the sequence -1...13- to 10 Nm.



Engine codes BKC, BXE

– Tighten bolts of the cylinder head cover hand tight in the sequence -1…13-.
– Tighten the bolts in the sequence -1...13- to 10 Nm.



1.3 Removing, installing and tensioning toothed belt

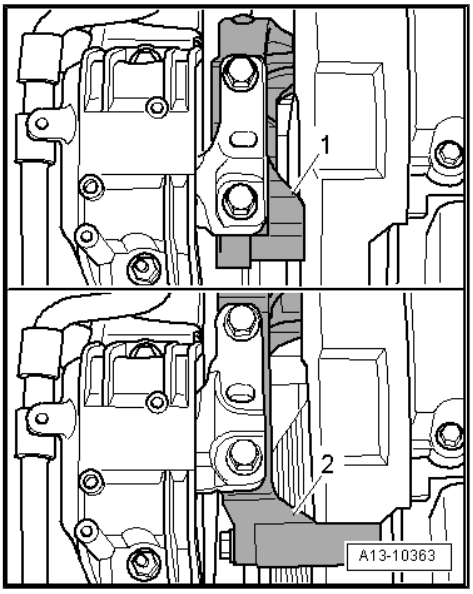
Note

From 05.05 a modified engine support has been introduced, it is no longer necessary to remove the engine support and supporting the engine for the procedure “removing, installing and tensioning toothed belt”.

– Determine which type of engine support is installed in the vehicle.

-1-: Engine support 05.05 (Removal necessary) ⇒ page 63

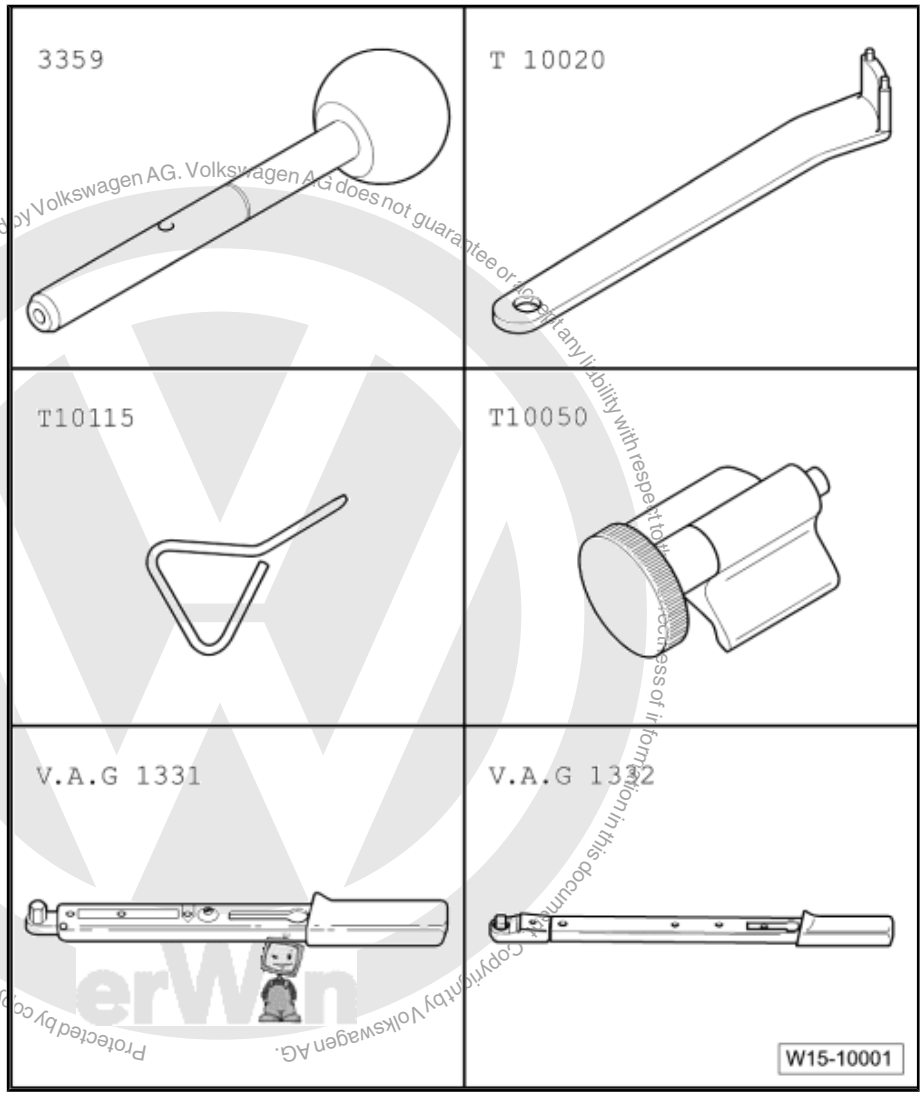
-2-: Engine support 06.05 (Removal not necessary)
⇒ page 72



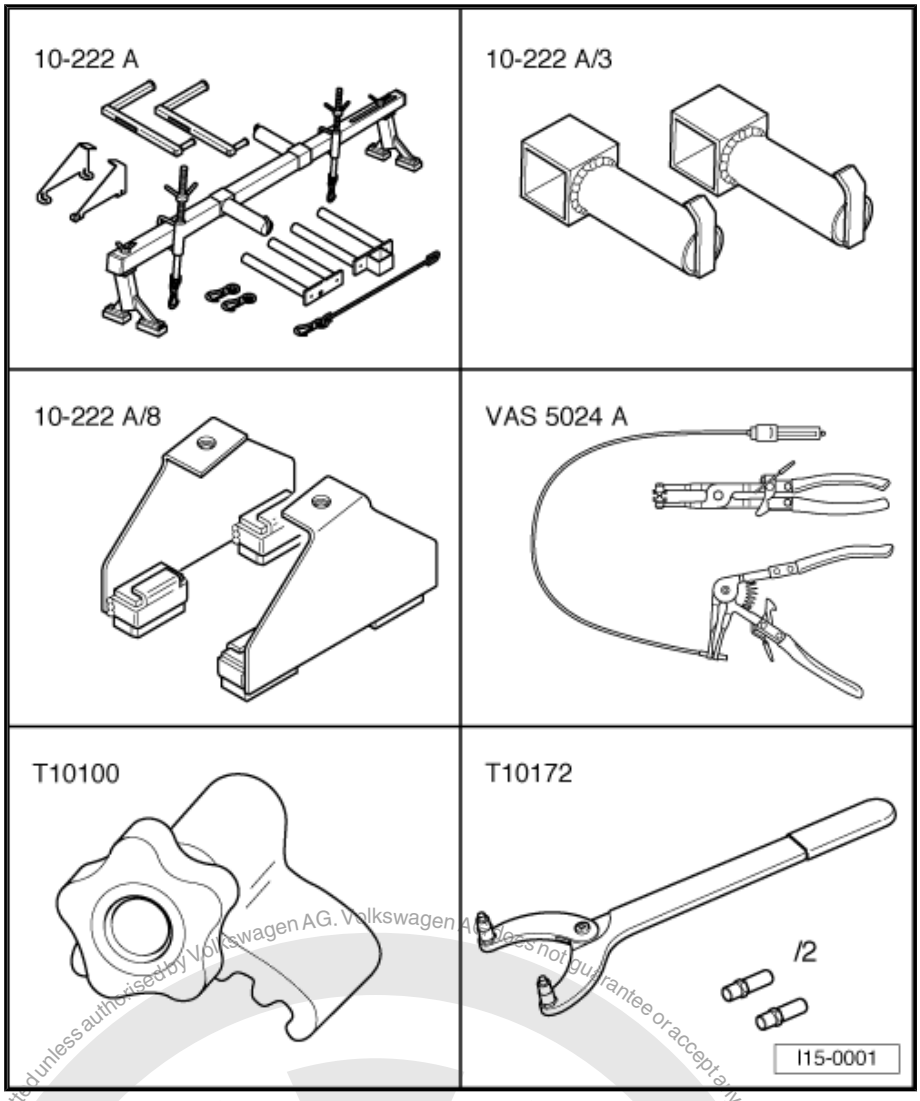
1.3.1 Removing and installing toothed belt (on vehicles 05.05)

Special tools and workshop equipment required

- Locking pin -3359-
- Pin wrench -T10020-
- Locking pin -T10115-
- Crankshaft stop -T10050- for round crankshaft toothed belt sprocket
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-



- Support bracket -10 - 222 A-
- Adapter -10 - 222 A/3-
- Frames -10 - 222 A/8-
- Spring-type clip pliers -VAS 5024A-
- Crankshaft stop -T10100- for oval crankshaft toothed belt sprocket
- Counter-hold -T10172- with
- Pins -T10172/4-

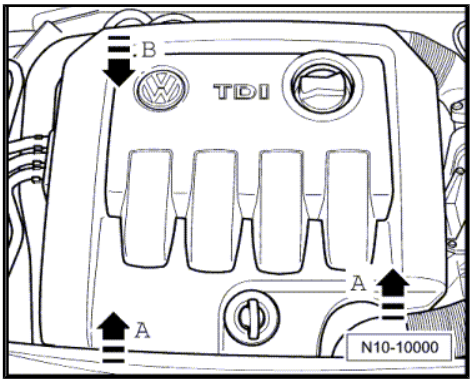


Removing

Note

Adjustment work on toothed belts must always be performed only on cold engines, as the indicator position on the tensioning element varies depending on the engine temperature.

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

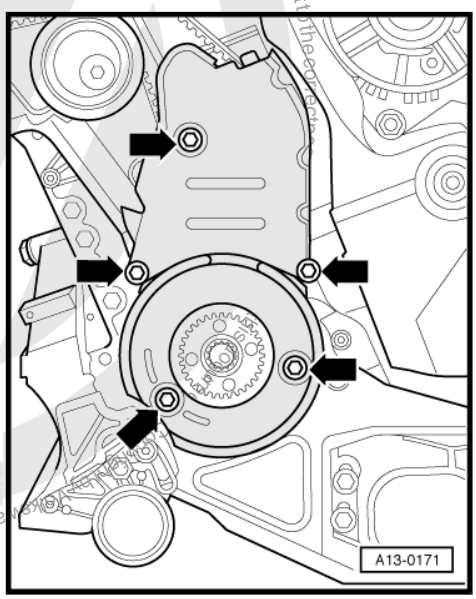


– Remove connecting pipe between charge air cooler and intake connecting pipe.
– Unscrew coolant expansion tank. Do not disconnect hoses.
– Remove poly-V-belt ⇒ page 29 .
– Remove locking pin from poly-V-belt tensioning element.
– Remove front right wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Wheel housing liner .
– Remove charge air pipe between charge air cooler and turbocharger ⇒ page 183 .
– Remove flexible charge air pipe between turbocharger and air filter.

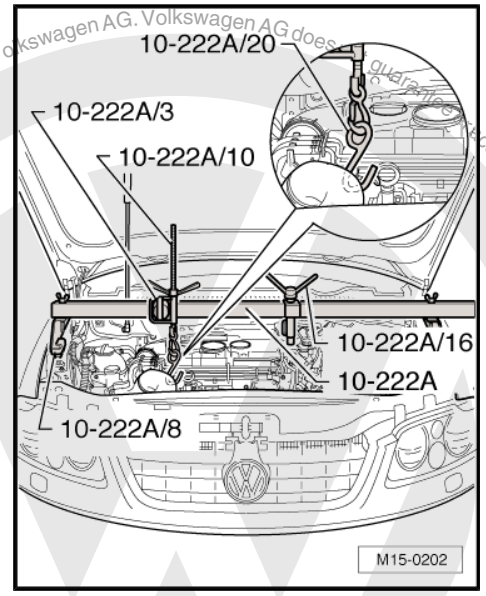
Note

Carefully seal openings of charge air duct, e.g. with a clean cloth to prevent particles of dirt from entering.

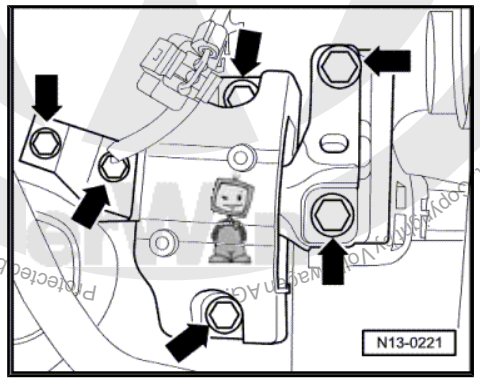
– Remove belt pulley with vibration damper.
– Unbolt toothed belt covers (bottom and centre) -arrows-.



– Fit support bracket -10 - 222 A- before the gas pressure damper for the front flap using adapter -10 - 222 A/8- , adapter - 10 - 222 A/3- and adapter -10 - 222 A/16- .
– Attach trigger snap of spindles to lifting eyes. On the right side use additionally the adapter -10 - 222 A/20-
– Take up weight of engine evenly with both spindles (but do not raise engine).



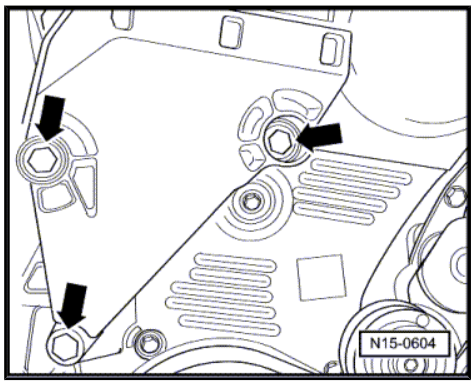
– Remove securing bolts -arrows- from the assembly mounting engine and take engine mounting out completely.



Note

- *The assembly mounting may only be removed if the engine is supported with support bracket -10 - 222 A- !*
- *The engine bracket must be loosened only when the assembly mounting has been removed.*

– Lift the engine slightly using the support device - 10 - 222 A- to loosen both engine bracket upper bolts -arrows-.
– Lower the engine slightly using the support device - 10 - 222 A- to loosen engine bracket lower bolt -arrow-.
– Remove engine bracket downwards.
– Turn crankshaft to TDC No. 1 cylinder.



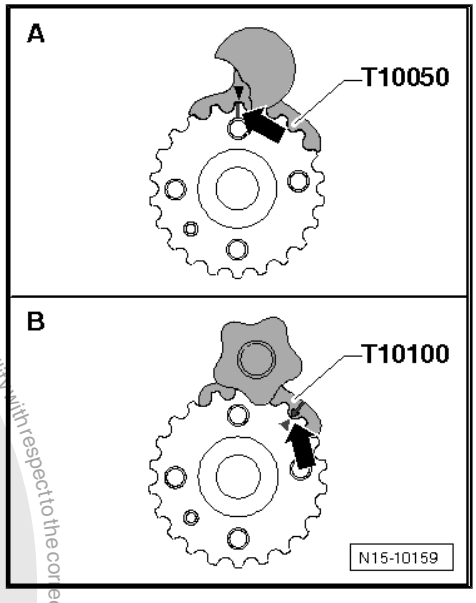
Note

Gradual introduction of oval crankshaft belt pulleys. When installing this toothed belt pulley, the crankshaft stop -T10100- must be installed to determine the TDC position.

Characteristics of crankshaft belt pulley

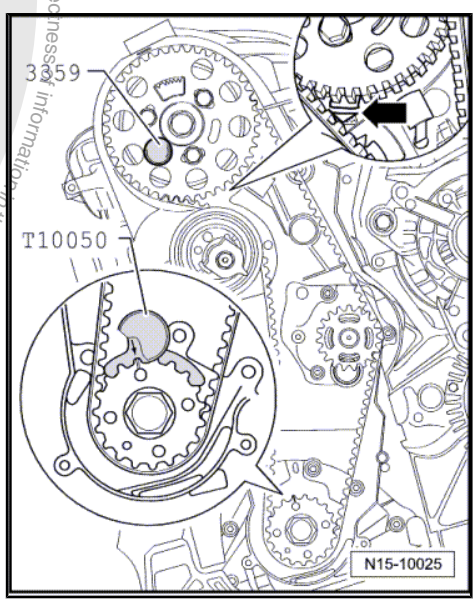
A = Round belt pulley, lock using crankshaft stop -T10050- , TDC marking at “12 o'clock”

B = Oval belt pulley, lock using crankshaft stop -T10100- , TDC marking at “1 o'clock”



Note

Turn crankshaft until marking on crankshaft pulley and tooth segment of camshaft pulley is on top. The marking on the rear toothed belt guard must align with the marking on the camshaft sender wheel -arrow-.



– Lock hub using locking pin - 3359- . To do this slide locking pin through the free elongated hole on left into hole in cylinder head.

– Lock crankshaft toothed belt pulley with crankshaft stop - T10050 or T10100- . To do this, push crankshaft stop into teeth of belt pulley from face side.

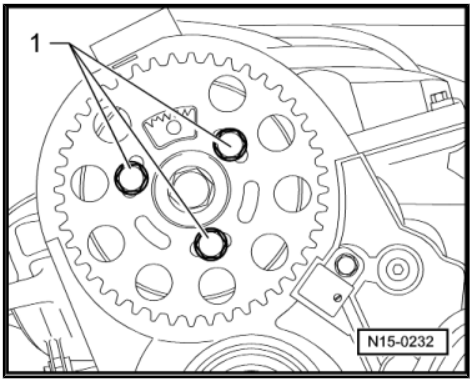
Note

The marks on the crankshaft toothed belt pulley and the crankshaft stop must align. When doing this, the pin of the crankshaft stop must insert in the drilling of the sealing flange.

– Mark direction of rotation of toothed belt.

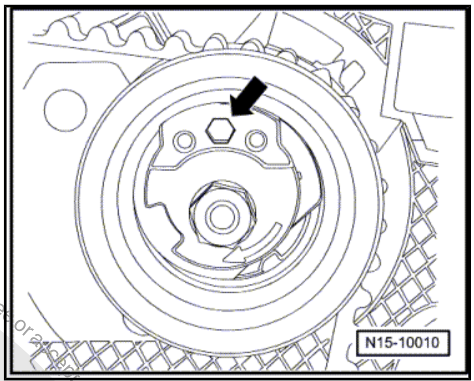
– Loosen securing bolts -1- of camshaft toothed belt pulley until camshaft pulley can be moved within the elongated holes.

– Loosen tensioning roller securing nut.

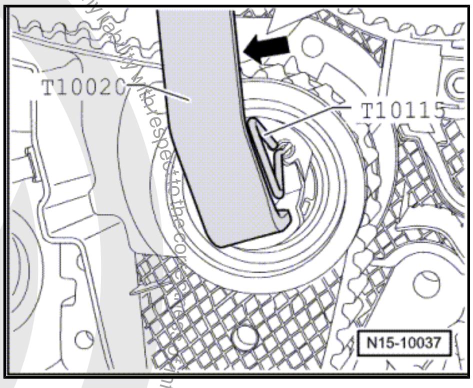


Note

Gradual introduction of a new toothed belt tensioning roller. The tensioner has an additional hexagon hole -arrow-. Use a hexagon key to tension/loosen toothed belt instead of the two-hole pin wrench -T10020- . This does not alter the procedure.

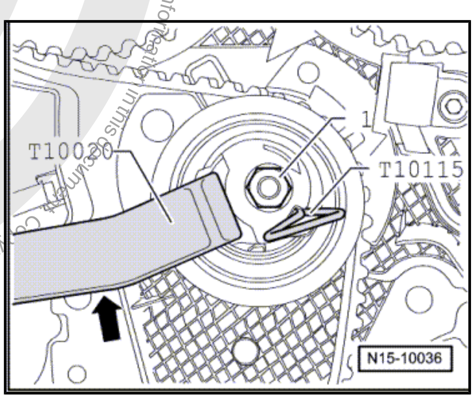


– Turn two-hole pin wrench -T10020 - anti-clockwise until the toothed belt tensioner can be locked in position using locking pin -T10115- .



– Now turn two-hole pin wrench -T10020 - clockwise onto top and tighten securing nut -1- hand tight.

– Remove toothed belt first from coolant pump and then from remaining pulleys.



Installing

- Lock camshaft with pin -3359- .
- Lock crankshaft with crankshaft stop -T10050 or T10100- .
- The tensioning roller must be fitted with pin -T10115- and locked right-hand.

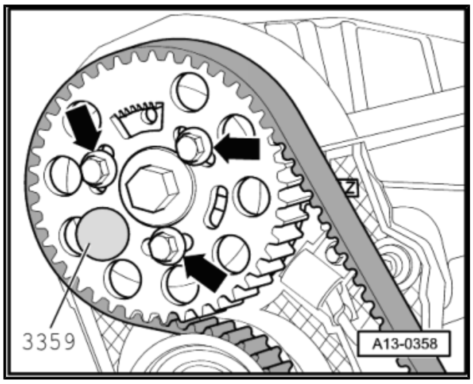
Note

Adjustment work on toothed belts must always be performed only on cold engines, as the indicator position on the tensioning element varies depending on the engine temperature.

– Turn camshaft sprocket in elongated holes to central position -arrow-.

– Fit toothed belt onto crankshaft toothed belt pulley, tensioning roller, camshaft toothed belt pulley and idler roller.

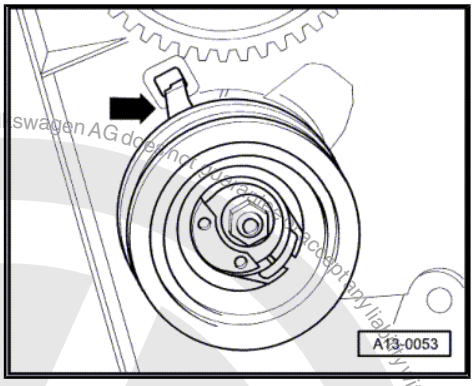
– Then fit toothed belt on coolant pump toothed belt pulley.



Note

Ensure that tensioning roller seats correctly in rear toothed belt guard -arrow-.

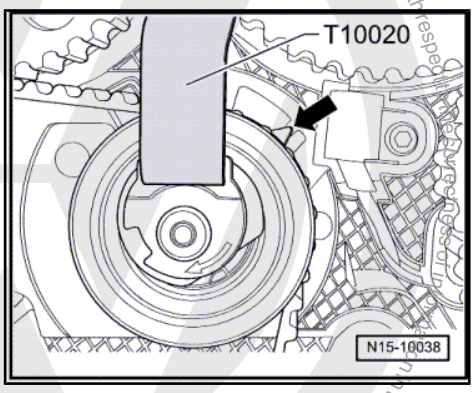
– Loosen tensioning roller securing nut and pull out locking pin -T10115- .



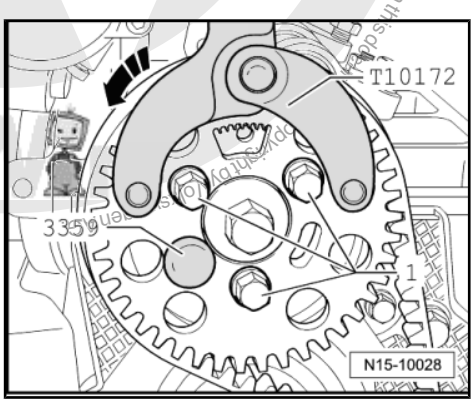
– Now turn carefully tensioning roller with two-hole pin wrench -T10020- clockwise until the indicator aligns over the lug -arrow- in the base plate.

Ensure that securing nut does not turn as well.

– Hold tensioning roller in this position and tighten tensioning roller securing nut as follows: 20 Nm and 45° (1/8 turn) further.

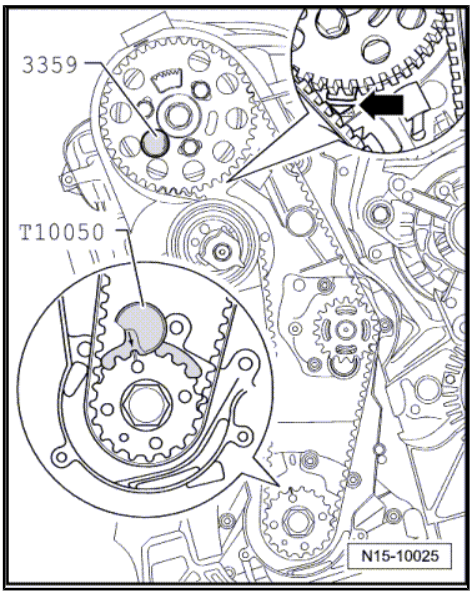


– Fit counter-hold tool -T10172- with pins -T10172/4- as shown. Press counter-hold -T10172- in -direction of arrow- and hold camshaft sprocket to pretension.
– In this position, tighten camshaft toothed belt pulley securing bolts -1- to 25 Nm.
– Remove locking pin -3359- and crankshaft stop -T10050 or T10100- .
– Turn crankshaft two rotations in engine direction of rotation until crankshaft is just before TDC No. 1 cylinder.

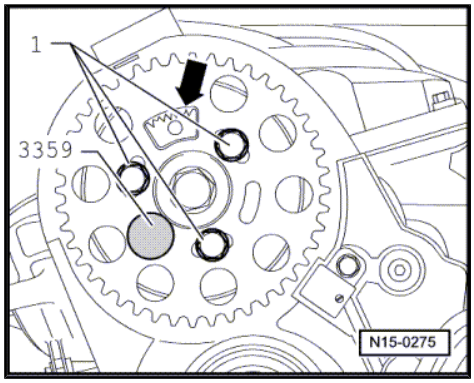


– Lock hub with locking pin -3359- whilst turning engine in direction of rotation.
– Check whether crankshaft can be locked with crankshaft stop -T10050 or T10100- .

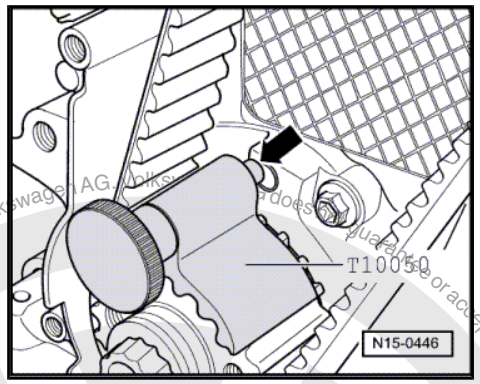
If crankshaft cannot be locked:



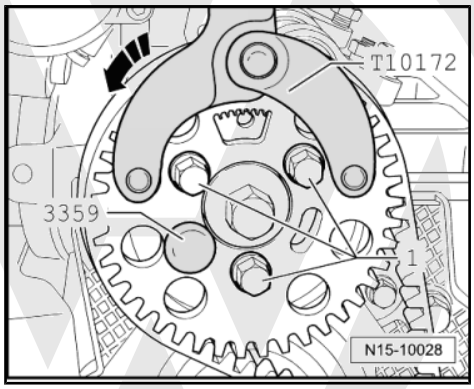
– Loosen securing bolts -1- for camshaft toothed belt pulley.
– Lock hub using locking pin - 3359- .



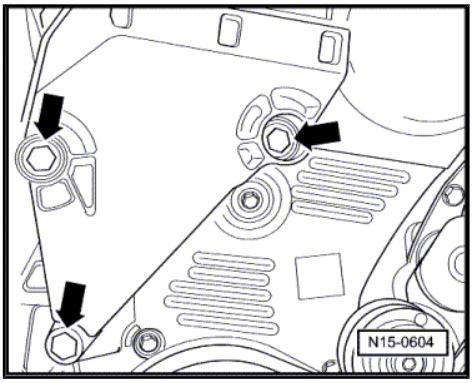
– Turn crankshaft slightly against engine direction of rotation until the crankshaft stop pin is positioned just before the hole in the sealing flange -arrow-.
– Now turn crankshaft in engine direction of rotation until crankshaft stop pin engages in sealing flange whilst turning.



– Fit counter-hold tool -T10172- with pins -T10172/4- as shown. Press counter-hold -T10172- in -direction of arrow- and hold camshaft sprocket to pretension.
– In this position, tighten camshaft toothed belt pulley securing bolts -1- to 25 Nm.
– Remove locking pin -3359- and crankshaft stop -T10050 or T10100- .
– Turn crankshaft two rotations in engine direction of rotation until crankshaft is just before TDC No. 1 cylinder.
– Repeat check.



– Place engine bracket at cylinder block and tighten securing bolts -arrows- to 40 Nm + 180 °(1/2 turn).



Note

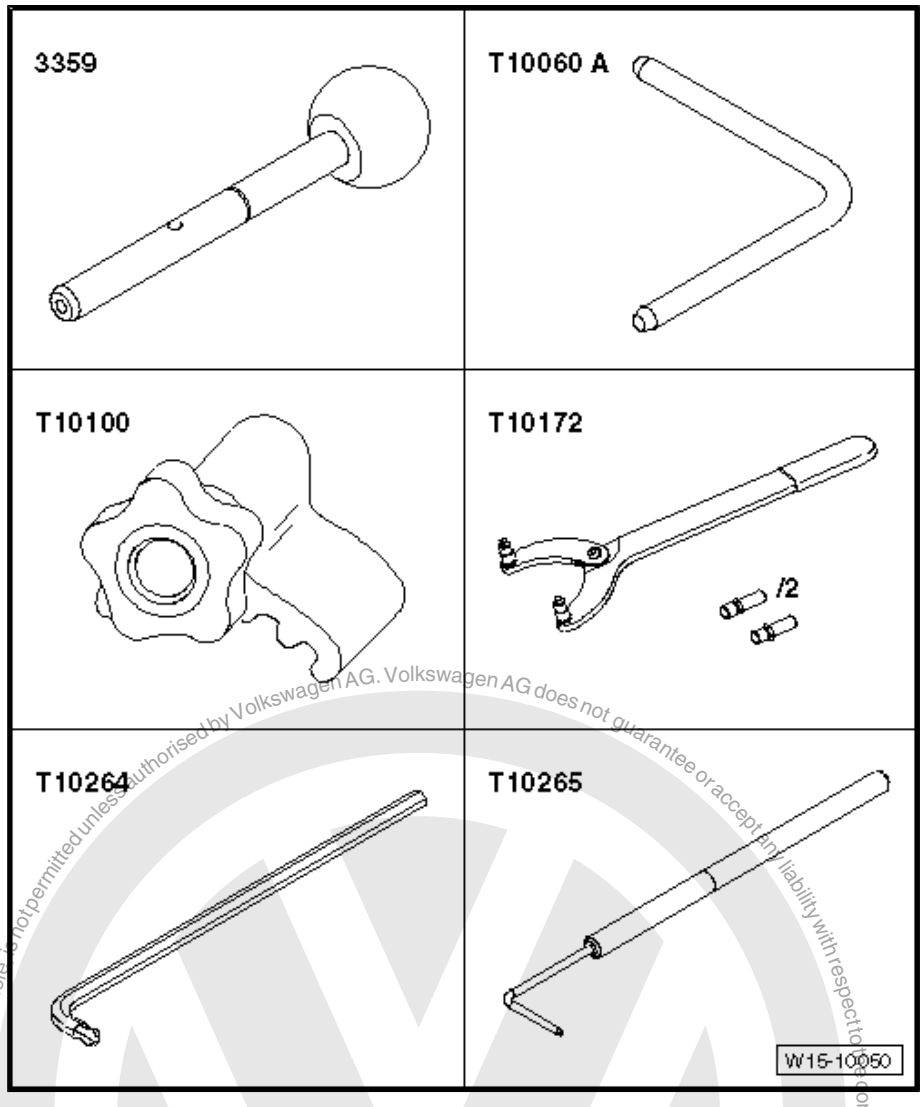
Before installing the assembly mounting, all engine mounting bolts -arrows- must be tightened to prescribed torque.

– Install assembly mounting engine/body (renew securing bolts) ⇒ page 23 .
– Fit engine mounting to engine bracket ⇒ page 23 . To do this put the contact surfaces on the support device -10 - 222A- .
– Install centre and lower parts of toothed belt guard.
– Install belt pulley vibration damper. Tightening torque: 10 Nm + 90° (1/4 turn) further.
– Install poly-V-belt ⇒ page 29 .
– Install upper toothed belt guard.
– Install connecting pipes between charge air cooler and turbo-charger and between charge air cooler and intake connecting flange ⇒ page 183 .
– Install front right wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Wheel housing liner .
– Install coolant expansion tank ⇒ page 119 .

1.3.2 Removing and installing toothed belt (on vehicles 06.05)

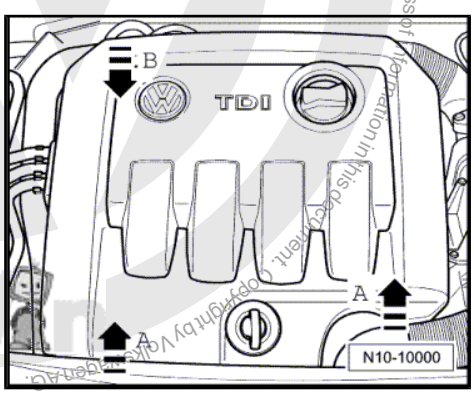
Special tools and workshop equipment required

- Locking pin for diesel injection pump -3359 -
- Mandrel -T10060 A-
- Crankshaft stop -T10100-
- Counter-hold tool -T10172-
- Socket -T10264-
- Locking tool -T10265-



Removing

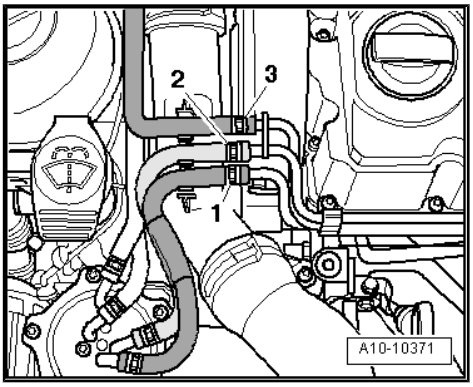
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



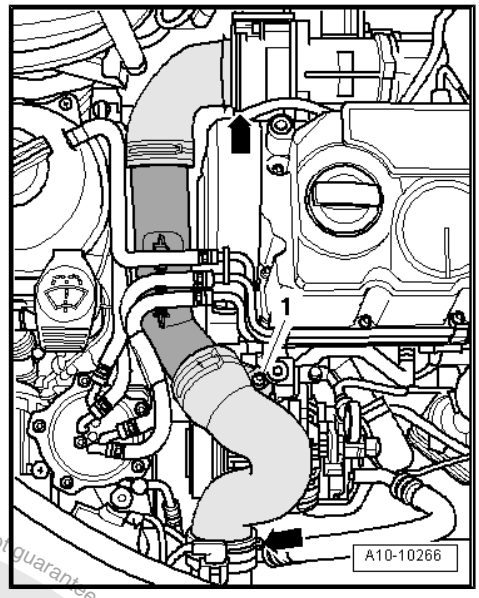
WARNING

- *In extreme cases the fuel lines and the fuel can reach a temperature of 100°C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear eye protection.*

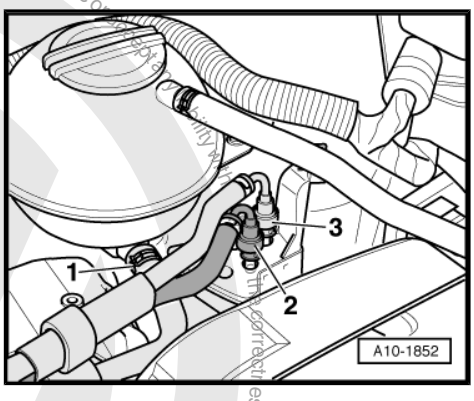
– Pull fuel supply hose -1- and fuel return hose -2- off fuel lines.
– Pull off coolant line -3-.
– Remove bolts -1-.



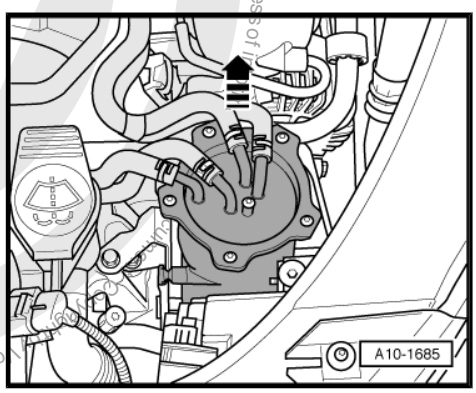
– Remove connecting pipe between charge air cooler and intake connecting pipe, to do this, lightly lift retaining clips -arrows-.



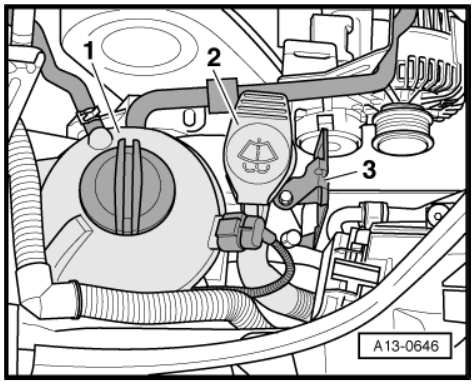
– Disconnect fuel supply line -3- and return line -2- by pulling release tabs.



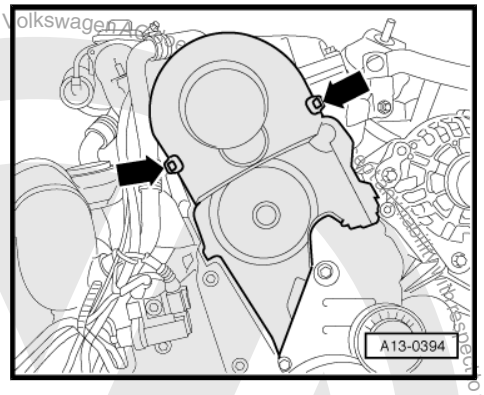
– Pull fuel filter out of bracket -arrow-.



– Unscrew bolt at filler neck -2- for washer fluid reservoir.
– Unscrew bracket -3- for fuel filter.
– Separate electrical connector on coolant expansion tank -1-.
– Remove coolant expansion tank, coolant hoses remain connected. Place it on engine.
– Remove poly-V-belt ⇒ page 29 .
– Remove tensioning element for poly-V-belt.



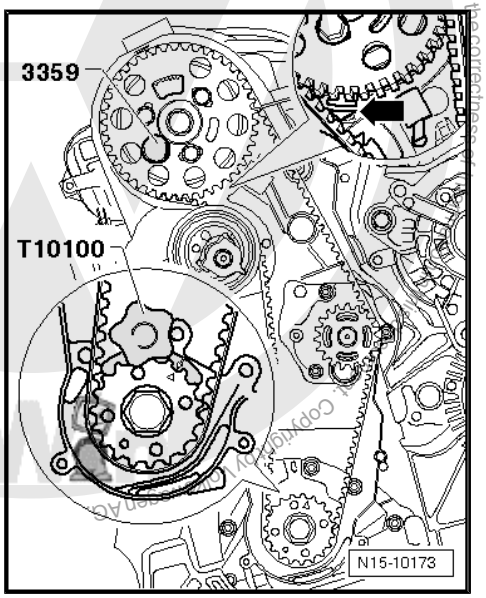
– Remove upper toothed belt guard, to do this, loosen retaining clips -arrows-.
– Remove front right wheel housing liner.
– Remove belt pulley with vibration damper.
– Remove lower and centre parts of toothed belt guard.
– Turn crankshaft to TDC No. 1 cylinder.



Note

Turn crankshaft until marking on crankshaft pulley and tooth segment of camshaft pulley is on top. The marking on the rear toothed belt guard must line up with the marking on the camshaft sender wheel -arrow-.

– Lock hub using locking pin -3359- . To do this slide locking pin through the free elongated hole on left into hole in cylinder head.
– Lock crankshaft toothed belt pulley with crankshaft stop -T10100- . To do this, push crankshaft stop into teeth of belt pulley from face side.

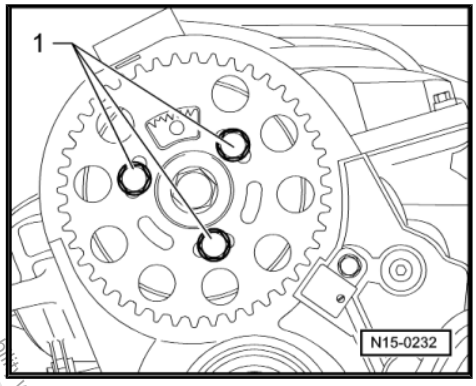


Note

The marks on the crankshaft toothed belt pulley and the crankshaft stop must align. When doing this, the pin of the crankshaft stop must insert in the drilling of the sealing flange.

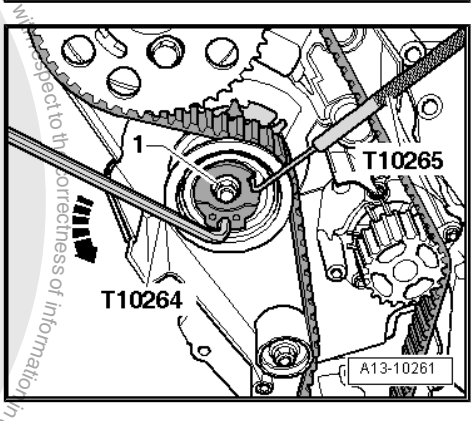
– Mark direction of rotation of toothed belt.

– Loosen securing bolts -1- of camshaft toothed belt pulley until camshaft pulley can be moved within the elongated holes.



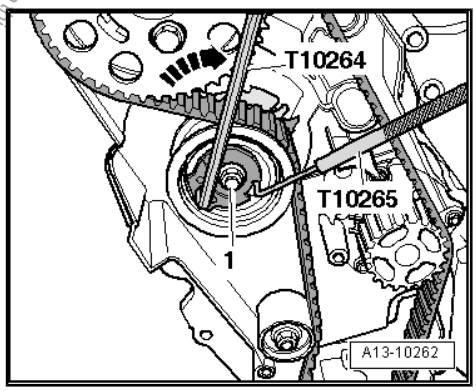
– Loosen tensioning roller securing nut -1-.

– Turn eccentric of tensioning roller anti-clockwise -arrow- using socket -T10264- until the tensioning roller can be locked with locking tool -T10265- .



– Now turn eccentric of tensioning roller clockwise -arrow- to stop and tighten securing nut -1- hand tight.

– Remove toothed belt first from coolant pump and then from remaining toothed belt pulleys.



Installing

- Camshaft locked with locking pin -3359- .
- Crankshaft locked with crankshaft stop -T10100- .
- Tensioning roller locked with locking pin -T10265- and secured to right stop with securing nut.

Note

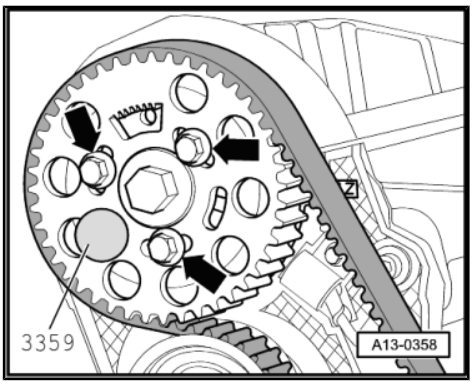
Adjustment work on toothed belts must always be performed only on cold engines, as the indicator position on the tensioning element varies depending on the engine temperature.

– Turn crankshaft toothed belt pulley in its elongated holes to centre position -arrows-.

– Guide toothed belt through gap between engine support and engine.

– Fit toothed belt onto crankshaft toothed belt pulley, tensioning roller, camshaft toothed belt pulley and idler roller.

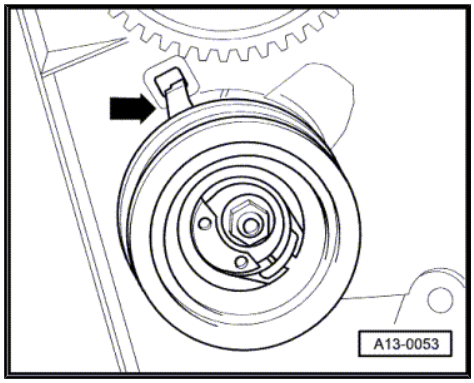
– Then fit toothed belt on coolant pump toothed belt pulley.



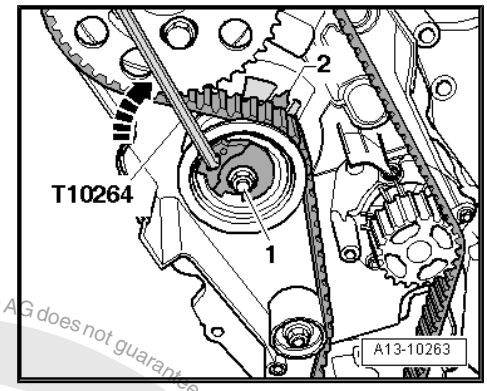
Note

Ensure that tensioning roller seats correctly in rear toothed belt guard -arrow-.

– Remove locking pin -T10265- from tensioning roller.
– Loosen tensioning roller securing nut -1-.



– Turn eccentric of tensioning roller clockwise -arrow- using socket -T10264- until indicator -2- is in middle of gap in base plate.

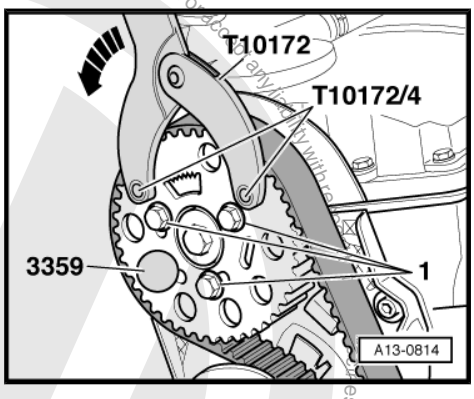


Note

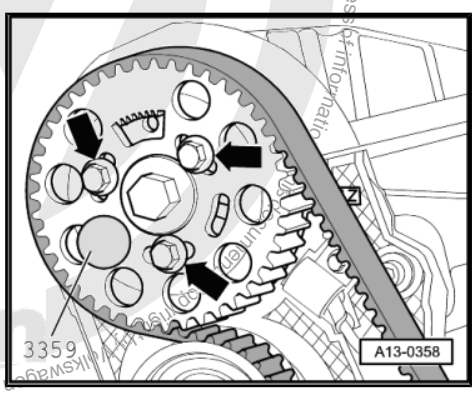
Ensure that securing nut does not turn as well.

– Hold tensioning roller in this position and tighten tensioning roller nut to 20 Nm + 45° ($^1/_8$ turn).

– Fit counter-hold tool -T10172- with pin -T10172/4- as shown in illustration and keep the toothed belt under tension on pulling side, by pressing in -direction of arrow-.
– Tighten bolts -1- of camshaft toothed belt pulley to 25 Nm.
– Remove locking pin -3359- and crankshaft stop -T10100- .
– Turn crankshaft two rotations in engine direction of rotation until the crankshaft is just before TDC again.

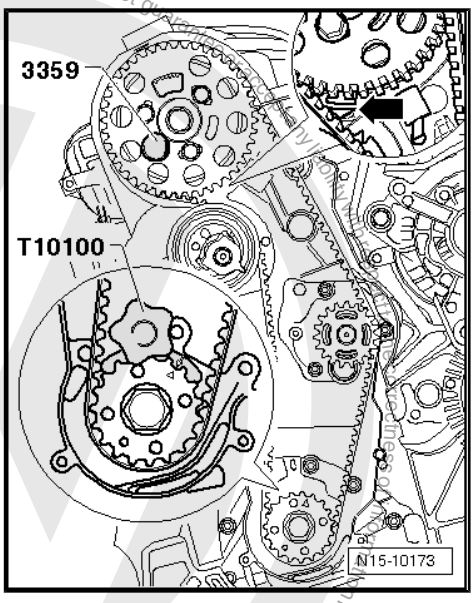


– Lock hub of camshaft with locking pin -3359- whilst turning engine in direction of rotation.

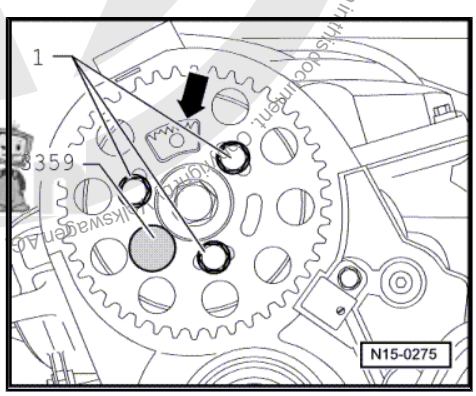


– Check whether crankshaft can be locked with crankshaft stop -T10100- .

If crankshaft cannot be locked

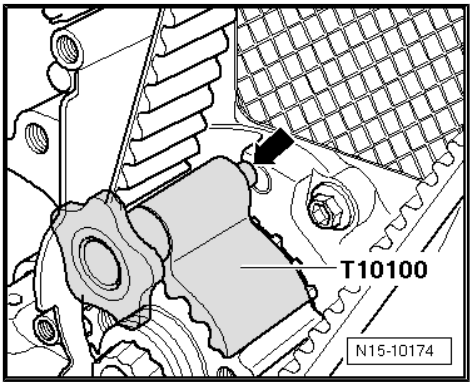


– Loosen securing bolts -1- for camshaft toothed belt pulley.

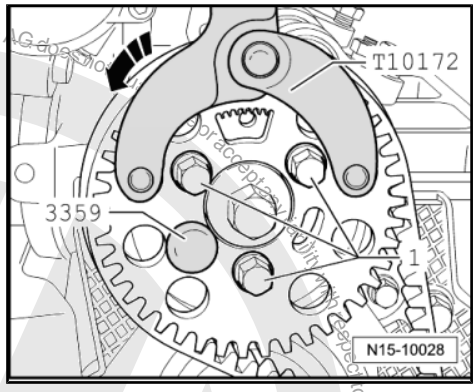


– Turn crankshaft slightly against engine direction of rotation until the pin of the crankshaft stop is positioned just before the hole in the sealing flange -arrow-.

– Now turn crankshaft in engine direction of rotation until crankshaft stop pin engages in sealing flange whilst turning.

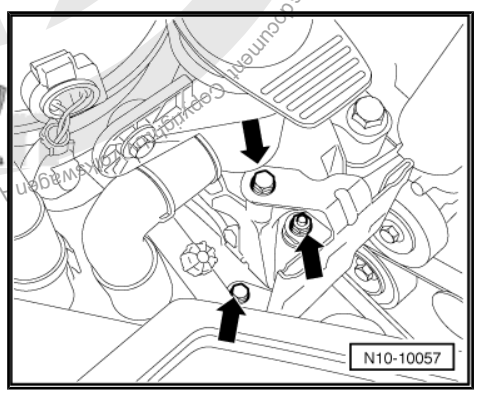


– Fit counter-hold tool -T10172- with pins -T10172/4- as shown. Press counter-hold tool -T10172- in direction of arrow, keeping camshaft toothed belt pulley under tension.



– In this position, tighten camshaft toothed belt pulley securing bolts -1- to 25 Nm.
– Remove locking pin -3359- and crankshaft stop -T10100- .
– Turn crankshaft two rotations in engine direction of rotation until crankshaft is just before TDC No. 1 cylinder.
– Repeat check and adjustment if necessary.
– Install centre and lower parts of toothed belt guard.
– Install belt pulley vibration damper. Torque setting: 10 Nm + 90° (1/4 turn) further.
– Install poly-V-belt ⇒ page 29 .
– Install upper toothed belt guard.
– Install connecting pipe between charge air cooler and intake connecting pipe.
– Install front right wheel housing liner.
– Install coolant expansion tank.

– Bolt fuel filter bracket to engine mount to 8 Nm torque -arrows-.

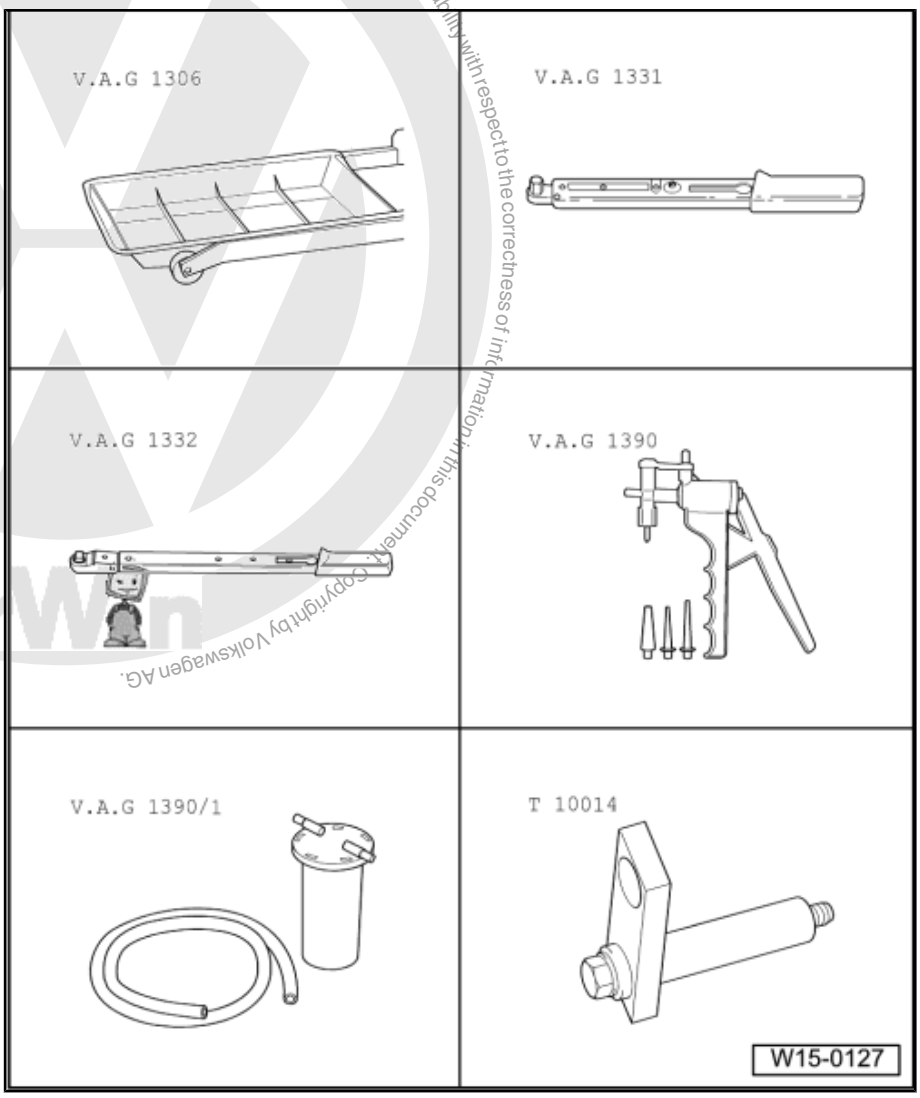


– Engage fuel filter in bracket.
– Bolt on filler neck for window wash system.
– Fit engine cover.

1.4 Removing and installing cylinder head

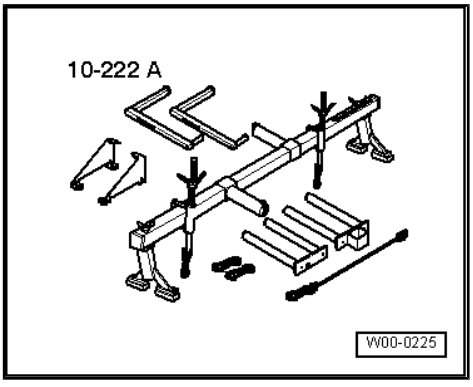
Special tools and workshop equipment required

- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1332-
- Diesel extractor -VAS 5226- or hand-operated vacuum pump with accessories -V.A.G 1390- and
- Water drainage container -V.A.G 1390/1 -
- Retainer -T10014- (only vehicles 05.05)



Special tools and workshop equipment required

- Support bracket -10 - 222 A- with frames -10 - 222 A/8- (only vehicles ‣ 05.05)



Note

All cable ties which are opened or cut through when cylinder head is removed must be replaced in the same position when cylinder head is installed.

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***

Removing ⇒ page 80

Installing ⇒ page 82

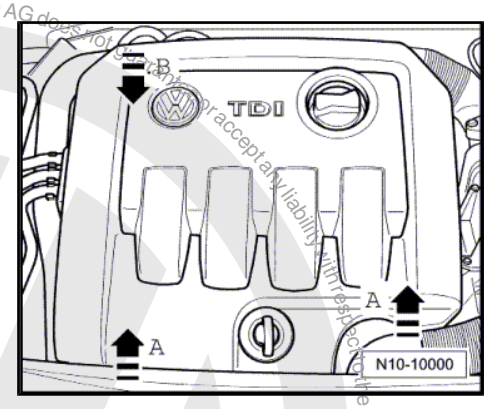
1.4.1 Removing

Note

Before removing cylinder head, extract fuel using hand-operated vacuum pump with accessories -V.A.G 1390- and water drainage container -V.A.G 1390/1- ⇒ page 166 *.*

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Remove bulkhead in plenum chamber ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Plenum chamber bulkhead .



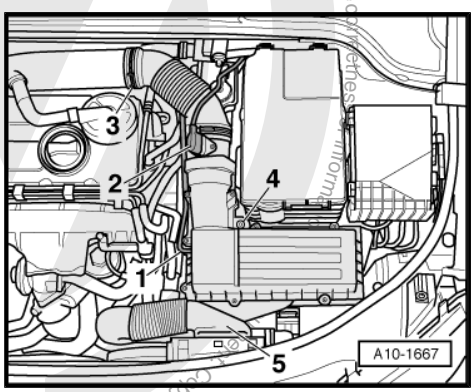
Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

– Disconnect connector -2- on air mass meter -G70- .

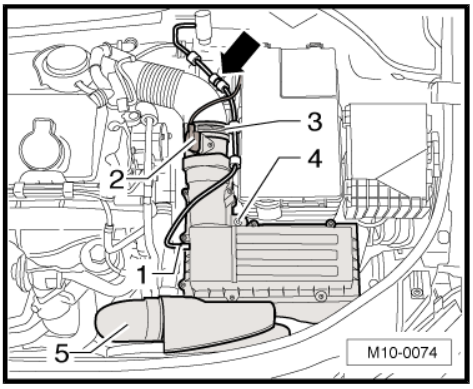
– Pull breather hose -1- and air duct hoses -3- and -5- off.

– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.



– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.

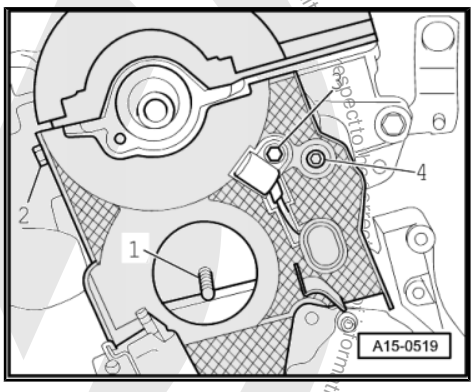
Continuation for all models

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Drain off coolant ⇒ page 127 .
– Disconnect fuel supply and return lines as well as coolant line on cylinder head.
– Before removing the cylinder head, extract fuel on tandem pump with diesel extractor -VAS 5226- or hand-operated vacuum pump with accessories -V.A.G 1390- and water drainage container -V.A.G 1390/1- ⇒ page 166 .
– Pull fuel filter module upwards out of bracket and lay it with hoses to side.
– Remove front exhaust pipe ⇒ page 248 .
– Remove turbocharger support and oil return from turbocharger.
– Remove oil supply pipe and lay oil supply pipe to side ⇒ page 114 .

Note

From 05.05 a modified engine support has been introduced; it is no longer necessary to remove the engine support and support the engine for the procedure "removing, installing and tensioning toothed belt" ⇒ page 62 .

– Remove toothed belt ⇒ page 62 .
– Remove tensioning roller for toothed belt.
– Remove hub for camshaft pulley ⇒ page 92 .



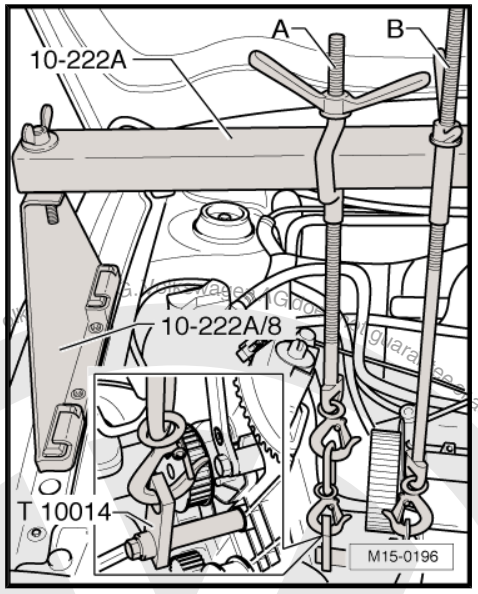
– Remove securing bolts for rear toothed belt guard -2- and -4- .
– Unscrew Hall sender -G40- -3-.
– Remove exhaust gas recirculation connecting pipe.
– Pull off or disconnect all other electrical connections as necessary from cylinder head and lay to one side.
– Separate all connection, coolant, vacuum and intake hoses from cylinder head.

Only vehicles 05.05

Note

Both lifting eyes for the support are located on the cylinder head, so an additional bracket for supporting the engine must be secured on the cylinder block.

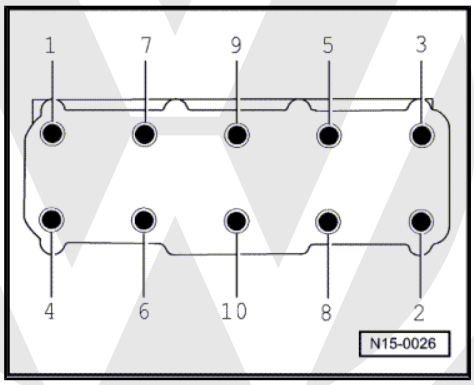
– Screw retainer -T10014- into threaded hole above coolant pump and tighten to 20 Nm.
– Then lift the engine slightly using the spindle -A- until the spindle -B- is relieved.
– Unhook spindle -B- and push it to side.



Continuation for all models

– Remove cylinder head cover ⇒ page 61 .

– Maintain sequence when loosening cylinder head bolts.
– Lift cylinder head slightly and remove from engine past toothed belt guard.



Note

The cylinder head must be guided carefully to prevent damage.

1.4.2 Installing

Note

- *Always renew cylinder head bolts.*
- *In cases of repair carefully remove gasket remains from cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces. When using abrasive paper do not use a grade less than 100.*
- *Carefully remove remains of emery and abrasives.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*

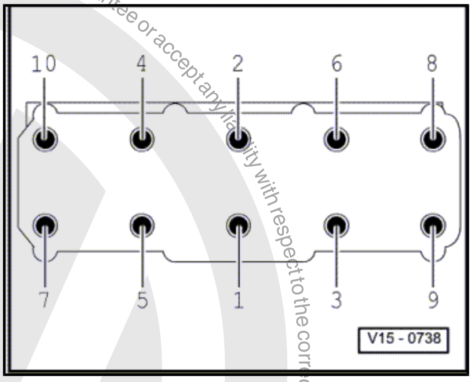
– Set crankshaft to TDC mark before fitting cylinder head.
– Turn crankshaft opposite engine direction of rotation until all pistons are approximately equally placed below TDC.
– Fit cylinder head gasket.

Note

Observe cylinder head gasket identification ⇒ page 60 .

– Fit cylinder head and tighten all cylinder head bolts hand-tight.

– Tighten cylinder head in four stages in sequence shown as follows:



1 - Tighten initially with torque wrench:

Stage I = 35 Nm

Stage II = 60 Nm

2 - Turn further with rigid wrench:

Stage III = $^{1}/_{4}$ turn (90°)

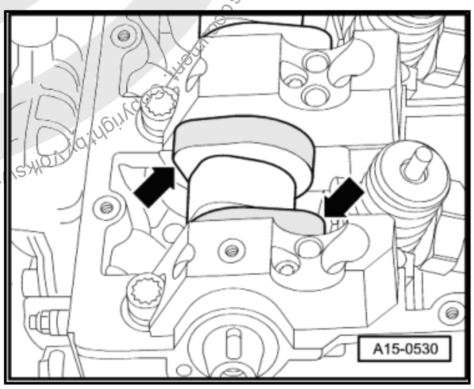
Stage IV = $^{1}/_{4}$ turn (90°)

Note

It is not necessary to retighten cylinder head bolts after repairs.

Further installation is carried out in the reverse order. In the process, note the following:

– After tightening the cylinder head, turn the camshaft hub so that the cam lobs -arrows- for cylinder No. 1 point evenly upwards. Turn crankshaft, in engine direction of rotation, to TDC marking before fitting toothed belt ⇒ page 62 .



– Install camshaft sprocket hub ⇒ page 92 .

– Install toothed belt ⇒ page 62 .

– Install poly-V-belt ⇒ page 29 .

– Install oil supply line ⇒ page 114 .

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Install bulkhead in plenum chamber ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Plenum chamber bulkhead .

– Fill coolant system with coolant ⇒ page 127 .

– Carry out road test and then read fault memory ⇒ page 243 .

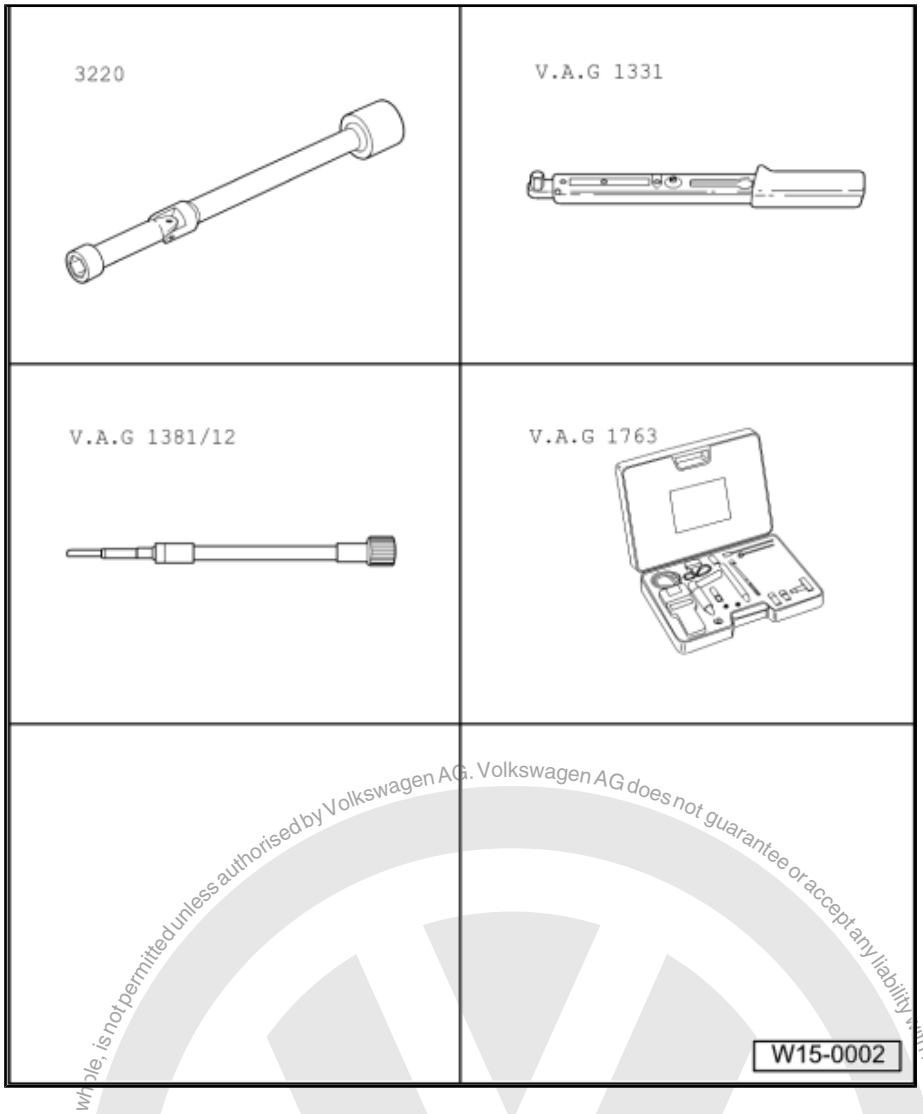
1.5 Checking compression

Note

If ceramic glow plugs are fitted, before removing check idling speed smooth running control using Vehicle diagnosis, testing and information system -VAS 5051B- . The compression test is warranted only if one or more cylinders stand out in this idling speed check.

Special tools and workshop equipment required

- Jointed spanner -3220-
- Torque wrench - V.A.G 1331-
- Adapter set - V.A.G 1381/12-
- Compression tester - V.A.G 1763 -



Test prerequisites

- Engine oil temperature min. 30°C

Test procedure

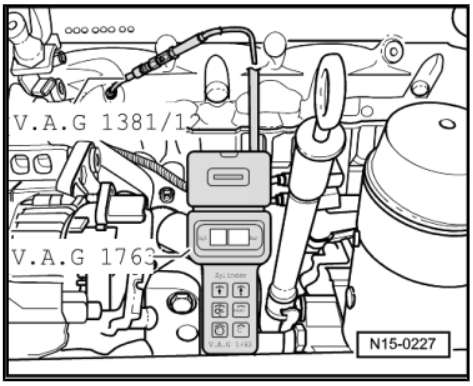
– Pull off central connector for unit injectors.

Note

If ceramic glow plugs are fitted, always observe notes on removing and installing ceramic glow plugs ⇒ page 274 .

– Remove all glow plugs or ceramic glow plugs using jointed extension and socket -3220- .

– Screw in adapter -V.A.G 1381/12 - in place of glow plugs or ceramic glow plugs.
– Check compression using compression tester -V.A.G 1763- .



Note

Using the compression tester ⇒ operating instructions .

– Operate starter until tester shows no further pressure increase.

Compression pressures:

New: 25...31 bar, wear limit: 19 bar.

Maximum permissible difference between all cylinders: 5 bar.

Note

If ceramic glow plugs are fitted, always observe notes on removing and installing ceramic glow plugs ⇒ page 274 .

– Remove glow plugs or ceramic glow plugs using jointed extension and socket -3220- .

Tightening torque: 15 Nm.

– Interrogate engine control unit fault memory ⇒ page 243 .

Note

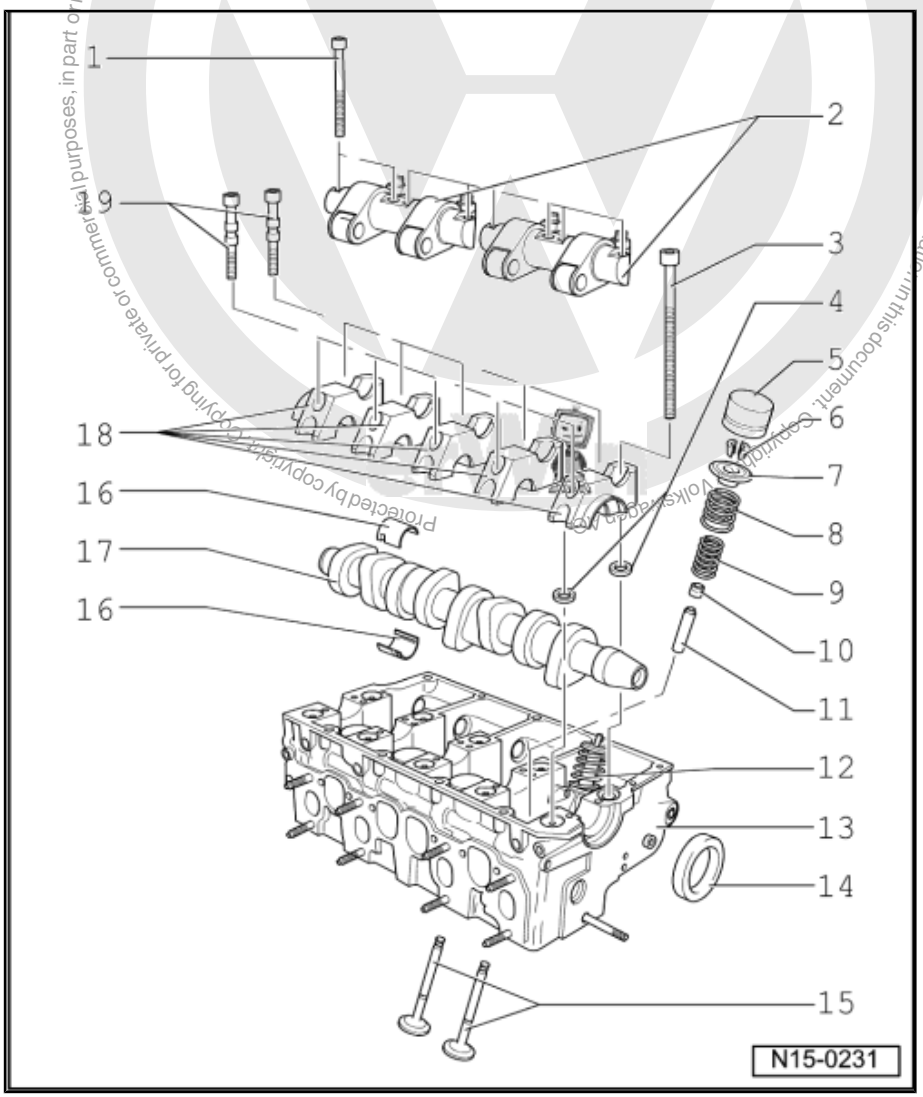
Disconnecting the central connector for unit injectors causes faults to be stored. Therefore read and clear fault memory.

2 Valve gear

Note

- *When installing an exchange cylinder head with fitted camshaft, the contact surfaces between the bucket tappets and the cam must be oiled before installing the cylinder head cover.*
- *The plastic protectors fitted to protect the open valves must not be removed until immediately before fitting the cylinder head.*
- *If the cylinder head is renewed, all the coolant in the system must also be renewed.*
- *Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.*
- *Do not rework valve seats. Only lapping in of valves is permitted.*
- *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic compensation elements must settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*
- *Always renew gaskets and seals.*

2.1 Assembly overview - valve gear



1 - 20 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ Note sequence for loosening and tightening ⇒ page 92

2 - Rocker arm shaft

- ❑ Do not interchange.

3 - Cylinder head bolt

- ❑ Renew.
- ❑ Note sequence for loosening and tightening ⇒ page 79
- ❑ Before installing, insert washers ⇒ Item 4 (page 87) in cylinder head.

4 - Washer

- ❑ For cylinder head bolts.
- ❑ Insert in cylinder head before installing bearing caps

5 - Bucket tappet

- ❑ Do not interchange.
- ❑ With hydraulic valve clearance compensation.
- ❑ Place down with contact surface facing downwards
- ❑ Before installing check camshaft axial clearance ⇒ page 88
- ❑ Oil contact surface.
- ❑ Before removing, remove camshaft bearing caps

6 - Cotters

7 - Valve spring plate

8 - Outer valve spring

- ❑ Removing and installing, cylinder head removed: using valve spring compressor -2037- .
- ❑ Removing and installing, cylinder head installed: ⇒ page 90

9 - Inner valve spring

- ❑ Removing and installing, cylinder head removed: using valve spring compressor -2037- .
- ❑ Removing and installing, cylinder head installed: ⇒ page 90

10 - Valve stem oil seal

- ❑ Renewing ⇒ page 90 .

11 - Valve guide

- ❑ Checking ⇒ page 89 .

12 - Unit injector

- ❑ Removing and installing ⇒ page 219 .

13 - Cylinder head

- ❑ See note ⇒ page 86 .

14 - Oil seal

- ❑ Do not additionally oil or grease sealing lip of oil seal
- ❑ Before installing, remove residual oil from camshaft journal using a clean cloth.
- ❑ Seal groove on camshaft taper when installing with commercially available sticky tape (e.g. Sellotape)
- ❑ Removing and installing ⇒ page 95 .

15 - Valves

- ❑ Valve dimensions ⇒ page 89

16 - Ball socket

- ❑ Do not interchange used bearing shells (mark)
- ❑ Ensure proper seating of retaining lugs in bearing caps and cylinder head.

17 - Camshaft

- ❑ Checking axial clearance ⇒ page 88
- ❑ Removing and installing ⇒ page 92 .
- ❑ Check radial clearance with plastigage, wear limit: 0.11 mm
- ❑ Runout: max. 0.01 mm.

18 - Bearing cap

- ❑ Installation sequence ⇒ page 92
- ❑ To install seal bearing cap contact surfaces 1 and 5 seal with sealant, black -AMV 174 004 01- ⇒ page 89

19 - 8 Nm + 90° (1/4 turn) further

- ❑ Renew.

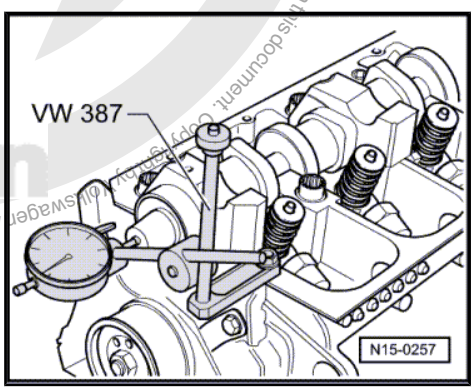
2.2 Checking axial clearance of camshaft

Special tools and workshop equipment required

- ♦ Universal dial gauge bracket -VW 387-
- ♦ Dial gauge

Check with bucket tappets removed and with first, third and last bearing caps fitted.

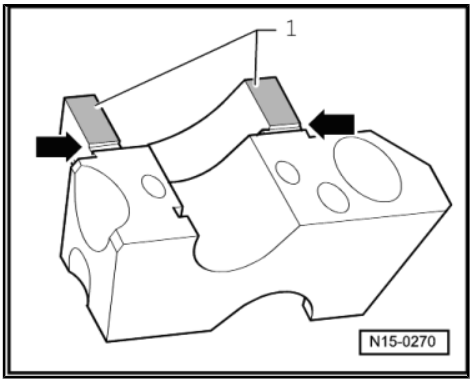
Wear limit: max. 0.15 mm.



2.3 Seal bearing caps 1 and 5 contact surfaces

Seal bearing cap contact surfaces 1 and 5 with sealant, black -AMV 174 004 01-

– Apply a thin even coat of sealant, black -AMV 174 004 01- onto surfaces -1-.



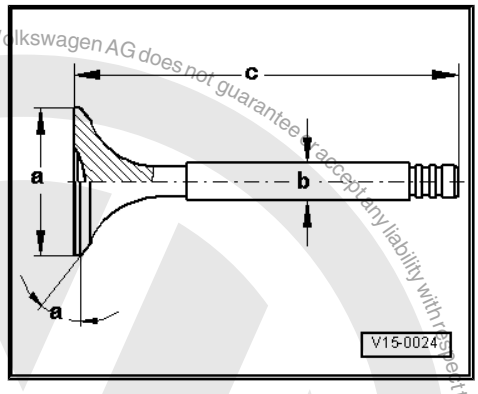
Note

Observe that no sealant comes into the grooves -arrows-.

2.4 Valve dimensions

Note

Inlet and exhaust valves must not be machined. Only lapping-in is permitted.

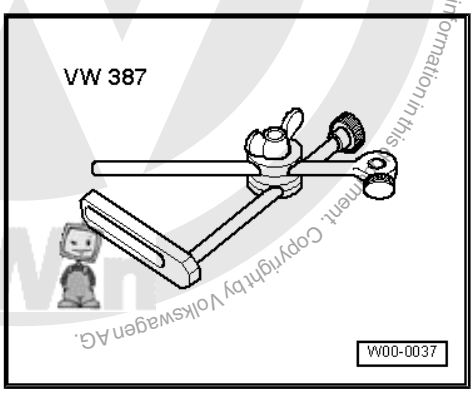


Dimension		Inlet valve	Exhaust valve
∅ a	mm	35.95	31.45
∅ b	mm	6.980	6.956
c	mm	89.95	89.95
α	∠°	45	45

2.5 Checking valve guides

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



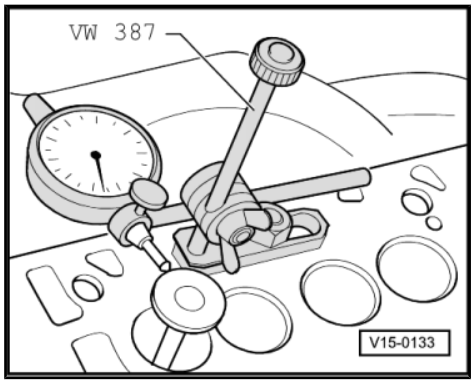
♦ Dial gauge

Test procedure

– Insert new valve into guide. The end of the valve stem must be flush with the guide. Due to differences in stem diameters, use only an inlet valve in inlet guide and an exhaust valve in exhaust guide.

– Determine rock. Wear limit: max. 1.3 mm.

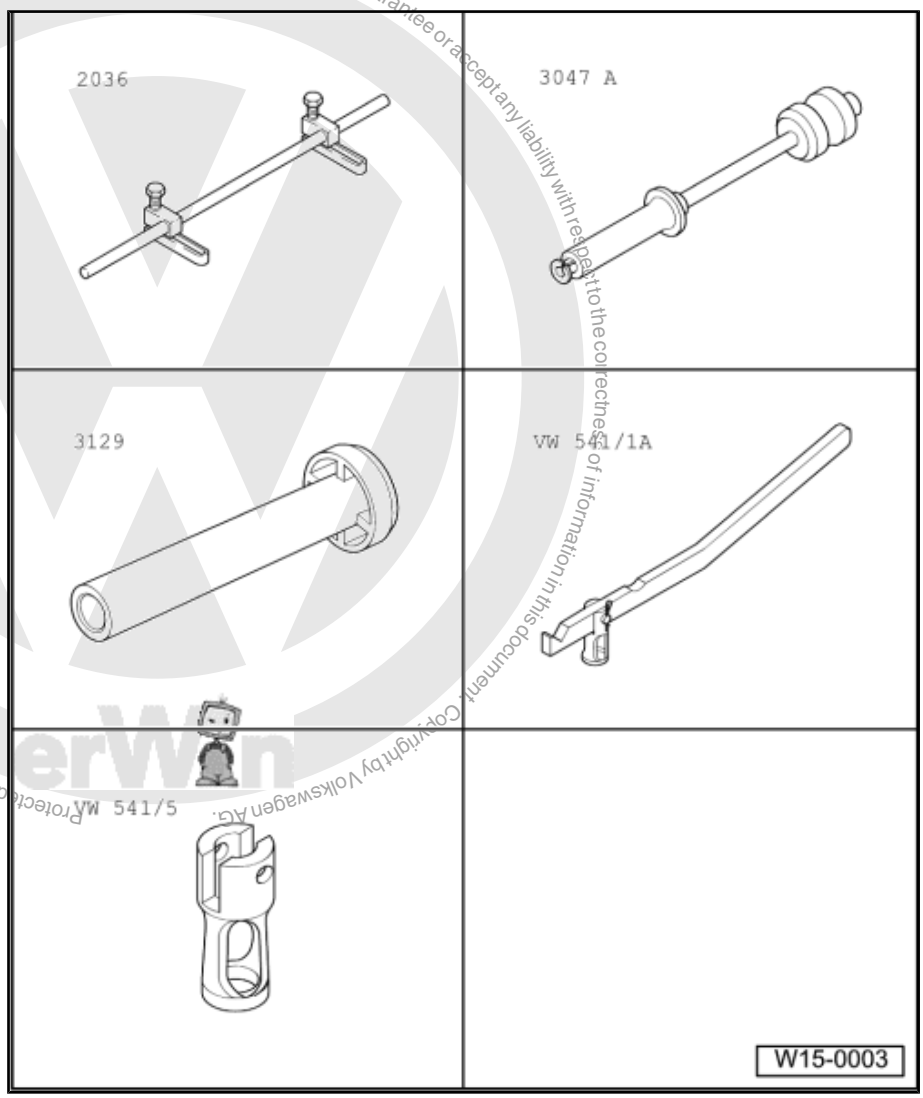
– Cylinder head must be renewed if rock exceeds wear limit.



2.6 Renewing valve stem oil seals

Special tools and workshop equipment required

- Assembly device -2036-
- Puller -3047 A-
- Valve stem seal fitting tool -3129-
- Valve lever -VW 541/1A-
- Thrust piece -VW 541/5-



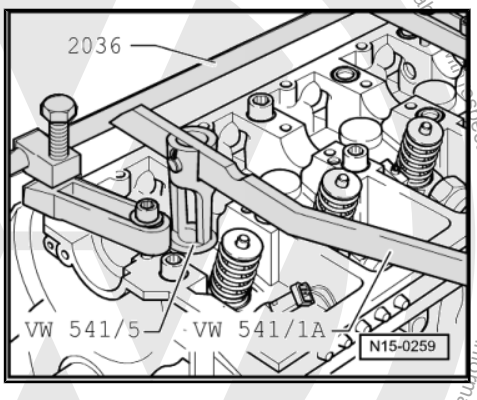
Removing ⇒ page 90

Installing ⇒ page 91

2.6.1 Removing

(with cylinder head installed)

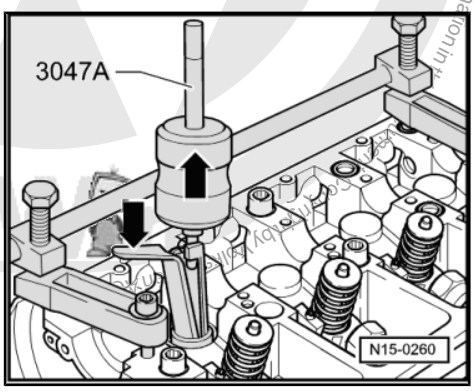
– Remove camshaft ⇒ page 92 .
– Remove bucket tappets and lay them down with the contact surface downwards. When doing this, ensure that tappets are not interchanged.
– Set piston of respective cylinder to top dead centre (TDC).
– Insert valve assembly device -2036- and adjust mounting to height of studs.
– Remove valve springs using lever -VW 541/1A- and thrust piece -VW 541/5- .



Note

The valves are supported by the piston crown.

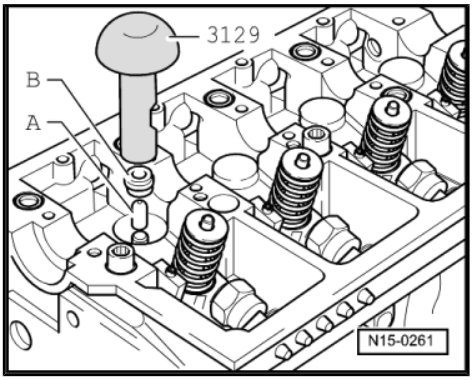
– Pull off valve stem seals using puller -3047 A- .



2.6.2 Installing

– Place the plastic sleeve -A- supplied on the appropriate valve stem. This will prevent the new valve stem seal -B- being damaged.
– Insert new valve stem seal in fitting tool -3129- .
– Lubricate sealing lip of valve stem seal and carefully push on valve guide.

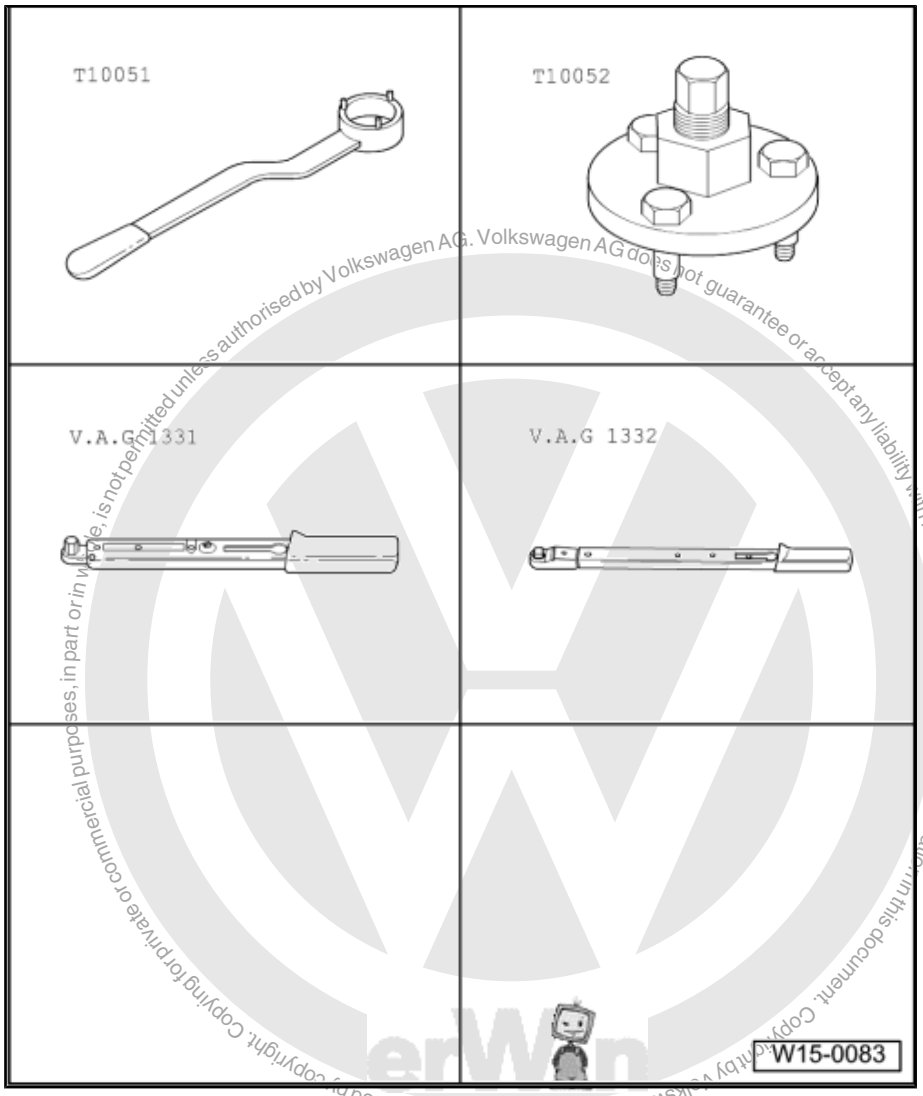
Further installation is carried out in the reverse order.



2.7 Removing and installing camshaft

Special tools and workshop equipment required

- Counter-hold tool -T10051-
- Puller -T10052-
- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1332-
- Sealant, black -AMV 174 004 01-

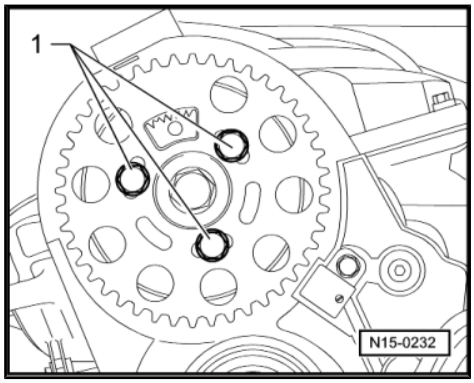


Removing ⇒ page 92

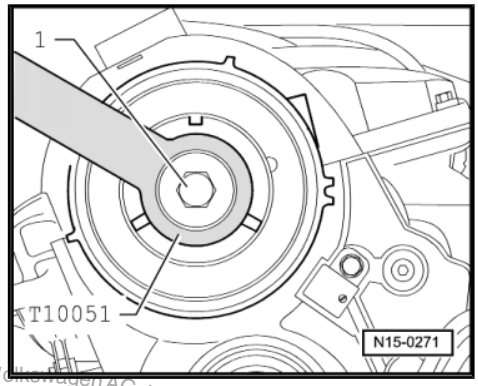
Installing ⇒ page 94

2.7.1 Removing

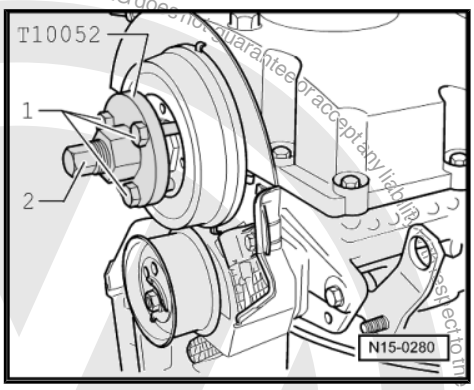
– Remove toothed belt ⇒ page 62 .
– Remove securing bolts for camshaft toothed belt pulley -1-.
– Pull camshaft toothed belt pulley off hub.



– Loosen hub securing bolt -1-.
– To do this, use counter-hold tool -T10051- .
– Loosen hub securing bolt about 2 turns.



– Apply puller -T10052- and screw securing bolts -1- into hub.
– Put the hub under pressure by tightening up the puller until the hub loosens from the camshaft taper.

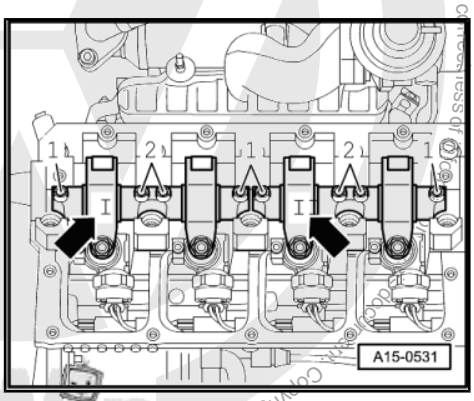


Note

When doing this, hold puller with 30 mm spanner.

– Remove hub from taper of camshaft.
– Remove cylinder head cover.

– Mark the rocker shafts -arrows-, e.g. with a waterproofed felt tipped pen to avoid confusion and therefore the injection pump basic setting.
– Remove rocker arm shafts.

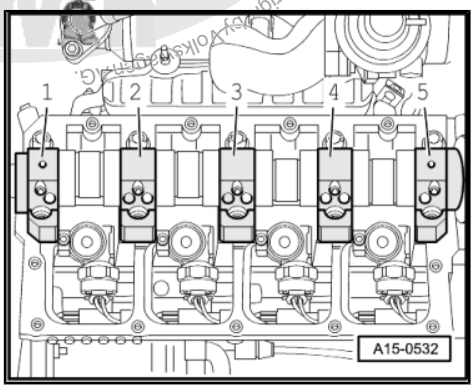


Note

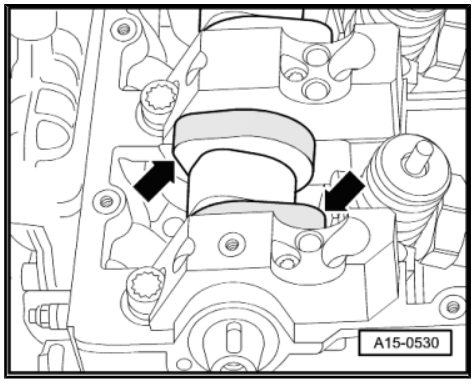
First loosen both outer and then inner securing bolts respectively.

– Remove tandem pump ⇒ page 166 .

– First remove bearing caps 5, 1 and 3. Then loosen bearing caps 2 and 4 alternately and diagonally.
– Remove camshaft.



2.7.2 Installing



Note

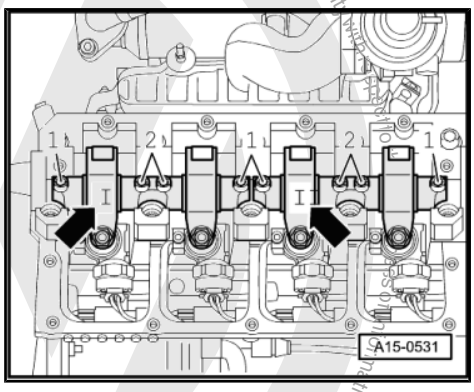
- *When camshafts are installed, cams -arrows- for No. 1 cylinder must point upwards.*
- *Do not interchange used bearing shells (mark).*
- *When installing the camshaft, ensure proper seating of retaining lugs in bearing caps and cylinder head.*
- *Before installing bearing caps, ensure that cylinder head bolt washers are inserted in the cylinder head.*

– Oil bearing shell running surface.
– Install bearing caps 2 and 4 using new bolts.
– Tighten bearing caps 2 and 4, using alternate and diagonal sequence to 8 Nm + 90° ($^1/_4$ turn).
– Install bearing caps 5, 1 and 3 using new bolts.

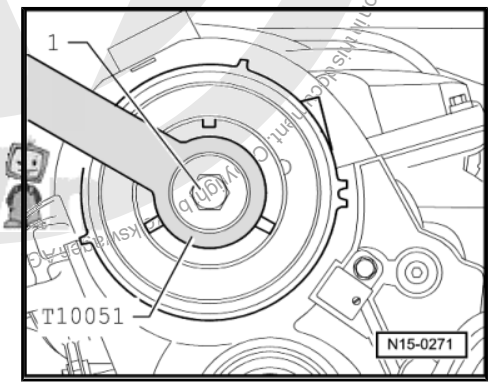
Note

- *Seal bearing cap contact surfaces 1 and 5 with sealant, black -AMV 174 004 01- ⇒ page 89*
- *Bearing cap 5 must align flush with outer edge of the cylinder head; otherwise this may lead to tandem pump leakage.*

– Tighten bearing caps 5, 1 and 3 also to 8 Nm + 90° ($^1/_4$ turn).
– Install camshaft oil seal ⇒ page 95 .
– Install rocker shafts and tighten inner -2- and then the outer -1- new securing bolts diagonally to 20 Nm + 90° ($^1/_4$ turn).
– Place hub on camshaft.

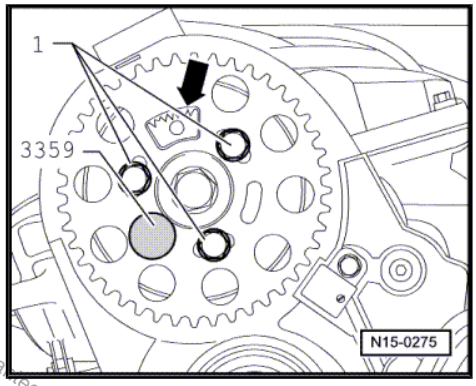


– Tighten hub securing bolt -1- to 100 Nm.
– To do this, use counter-hold tool -T10051- .
– Push camshaft toothed belt pulley onto hub.



Note

The toothed segment -arrow- of the camshaft belt pulley must be on top.



- Align camshaft toothed belt pulley at centre of elongated holes.
- Hand tighten securing bolts -1- to camshaft toothed belt pulley so that there is no play.
- Lock hub using locking pin -3359- .
- Install and tension toothed belt ⇒ page 62 .
- Install tandem pump ⇒ page 166 .

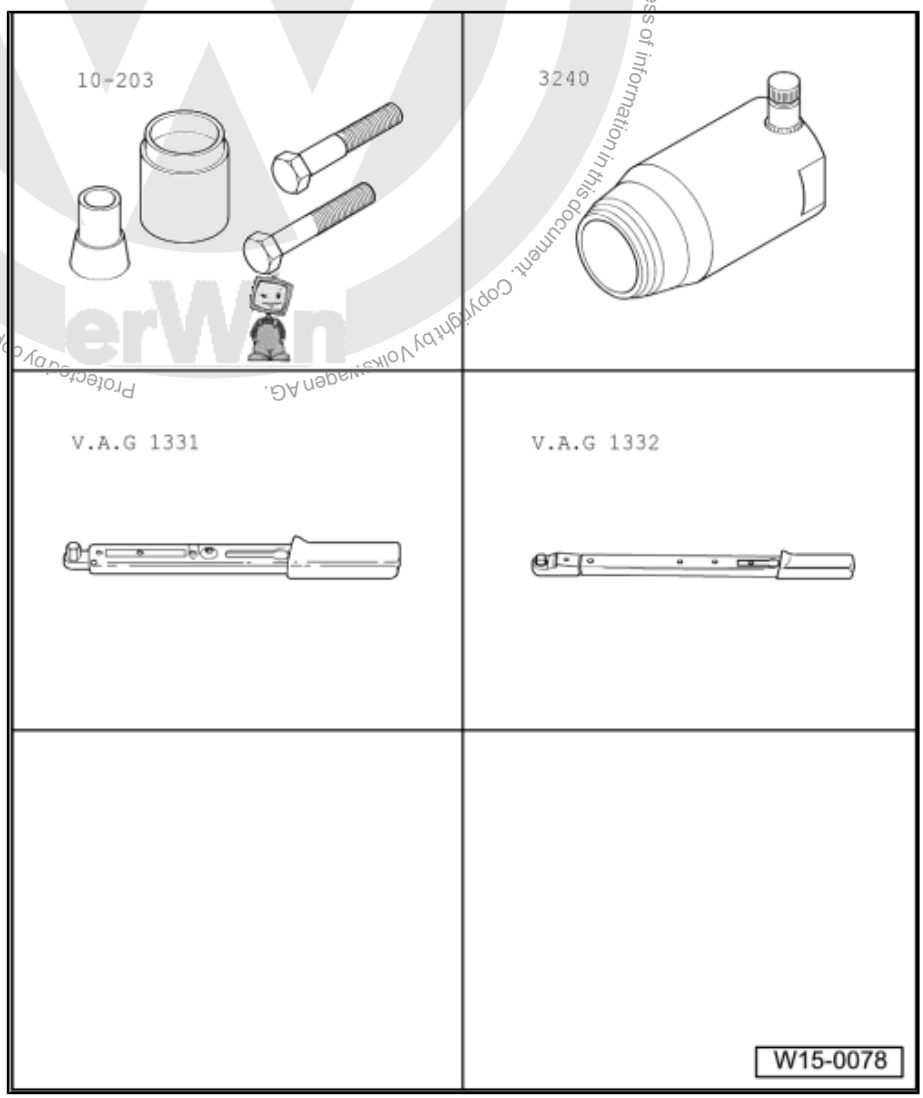
Note

Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic compensation elements must settle (otherwise valves will strike pistons).

2.8 Removing and installing camshaft oil seal

Special tools and workshop equipment required

- Fitting tool -10 - 203-
- Oil seal extractor -3240-
- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1332-



♦ Bolt/screw -M12×1,5 x 65-

Removing ⇒ page 96

Installing ⇒ page 96

2.8.1 Removing

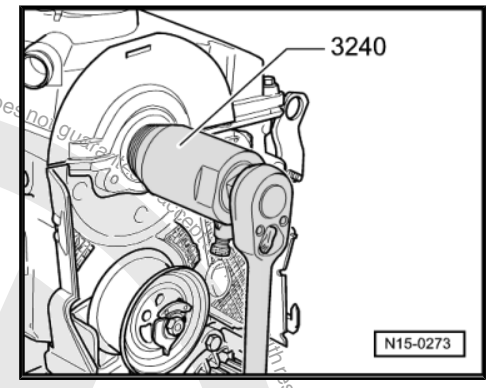
– Remove toothed belt ⇒ page 62 .

– Remove camshaft pulley and hub ⇒ page 92 .

– Unscrew inner part of oil seal extractor - 3240- two turns (approx. 3 mm) out of outer part and lock with knurled screw.

– Lubricate threaded head of oil seal extractor -3240- , place it in position and exerting firm pressure screw it into oil seal as far as possible.

– Loosen knurled screw and turn inner part against camshaft until the oil seal is pulled out.



2.8.2 Installing

Note

The oil seal sealing lip must not be additionally oiled or greased.

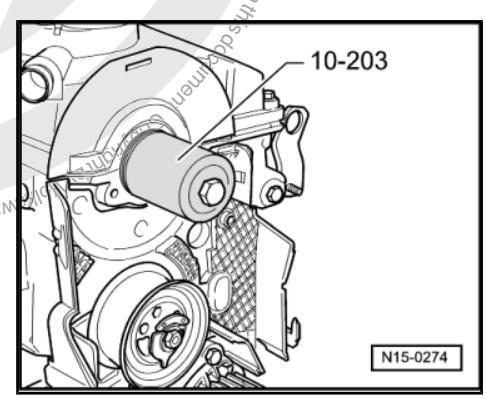
– Remove oil residue from camshaft journal using a clean cloth.

– Tape over groove in taper of camshaft (e.g. with Sellotape).

– Fit oil seal carefully on camshaft.

– Press in seal with pressure piece of pulling device -10 - 203- and screw -M12×1,5 x 65- onto limit stop.

– Install and tension toothed belt ⇒ page 62 .



17 – Lubrication

1 Engine oil

Note

The oil level must not be above the max. mark, danger of damage to catalytic converter!

Engine oil specification ⇒ page 97

Oil capacities ⇒ page 97

Checking engine oil level ⇒ page 97

1.1 Engine oil specification

⇒ Maintenance ; Booklet 38

1.2 Oil capacities

Engine codes BKC and BXE

With oil filter change 3.8 l.

Without oil filter change 3.3 l.

Engine codes BLS and BRM

With oil filter change 4.3 l.

Without oil filter change 3.8 l.

Top up to max. marking if necessary ⇒ page 97 .

1.3 Checking engine oil level

Test prerequisites

- Engine oil temperature at least 60°C.
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test procedure

– Pull out the dipstick, wipe off with a clean cloth and insert it again onto stop.

– Pull out the dipstick again and read off the oil level.

Markings on oil dipstick

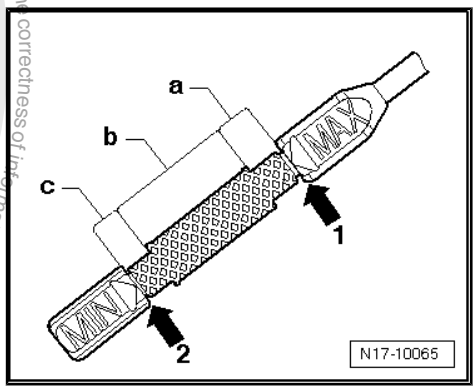
1 - Max. mark

2 - Min. mark

a - Area above grooved section up to max. mark: Do not top up with engine oil!

b - Oil level in grooved section: Can be topped up with engine oil.

c - Area from min. mark up to grooved section: Must be topped up, max. 0.5 l of engine oil!



2 Parts of lubrication system

Caution

Finding metal shavings or a large quantity of small metal particles during engine repair could indicate that the crankshaft bearings or conrod bearings are damaged. To prevent this from causing further damage, perform the following repairs:

Thoroughly clean oil passages.

Replace oil cooler.

Renew oil filter element.

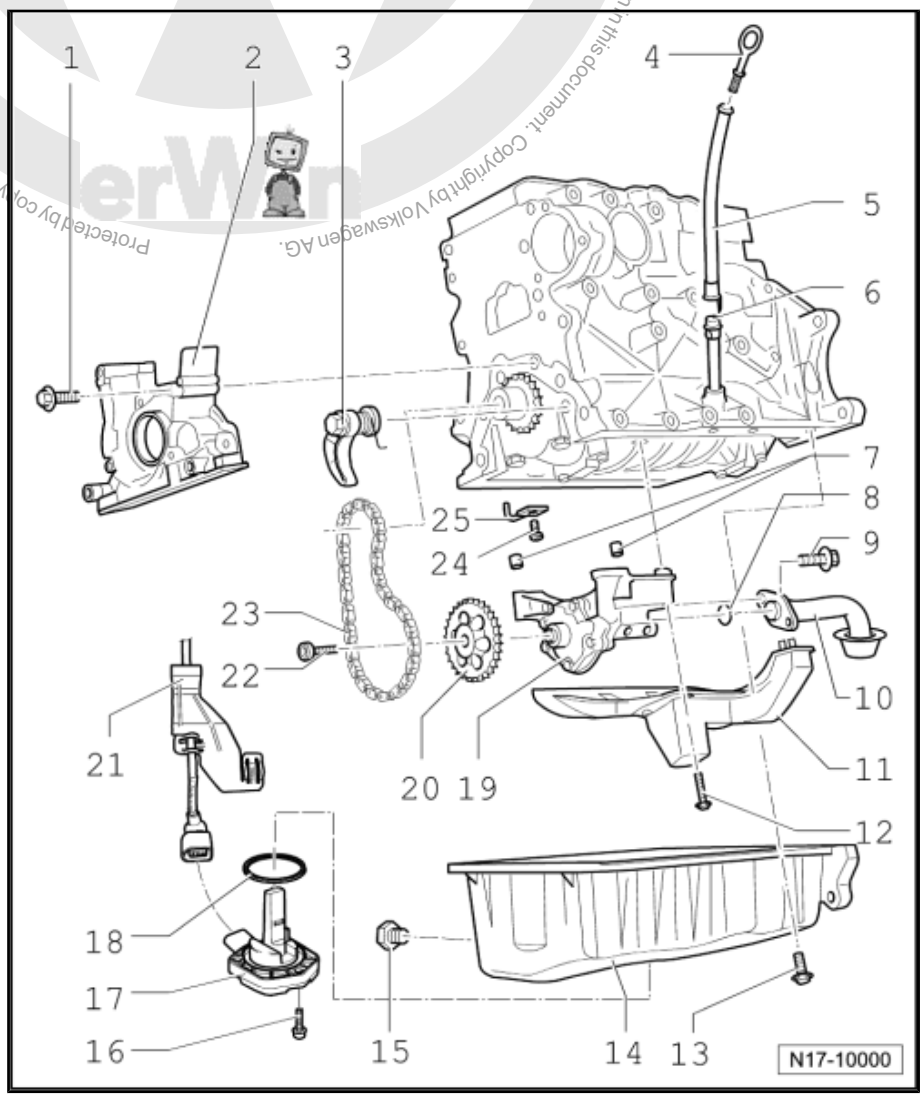
Oil pump, oil sump - assembly overview, engine codes BKC, BLS, BXE ⇒ page 98

Oil pump, oil sump - assembly overview, engine code BRM ⇒ page 100

Removing and installing sump ⇒ page 101

Removing and installing oil pump ⇒ page 104

2.1 Oil pump, oil sump - assembly overview, engine codes BKC, BLS, BXE



1 - 15 Nm

2 - Sealing flange

- ❑ With oil seal
- ❑ Must seat on dowel sleeves.
- ❑ Removing and installing ⇒ page 35
- ❑ Install with silicone sealant -D 176 404 A2- ⇒ page 35
- ❑ Do not additionally oil or grease the oil seal sealing lip.
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ❑ Renewing crankshaft oil seal - belt pulley end- ⇒ page 33

3 - Chain tensioner with tensioning rail, 15 Nm

- ❑ When installing, pretension spring and engage

4 - Oil dipstick

- ❑ The oil level must not be above the max. mark!
- ❑ Markings ⇒ page 97

5 - Dipstick guide

6 - Guide tube

7 - Dowel sleeves

8 - O-ring

- ❑ Renew.

9 - 15 Nm

10 - Suction line

- ❑ Clean strainer if soiled

11 - Baffle plate

12 - 15 Nm

13 - 15 Nm

14 - Sump

- ❑ Clean sealing surface before installing
- ❑ Install with silicone sealant -D 176 404 A2-
- ❑ Removing and installing ⇒ page 101 .

15 - Oil drain plug, 30 Nm

- ❑ With attached seal.
- ❑ Renew.

16 - 10 Nm

17 - Oil level and oil temperature gauge -G266 -

- ❑ Connector, black, 3-pin.

18 - Oil seal

- ❑ Renew.

19 - Oil pump

- ❑ With 12 bar pressure relief valve.
- ❑ Before installing, check that both dowel sleeves ⇒ Item 7 (page 98) are fitted for centralising oil pump/ cylinder block.
- ❑ Renew if running surfaces and gears are scored.

20 - Oil pump chain sprocket

21 - Retainer

- ❑ For Oil level and oil temperature sender -G266- wiring harness

22 - 20 Nm + 90° (1/4 turn) further

- ❑ Renew.

23 - Chain

24 - 25 Nm

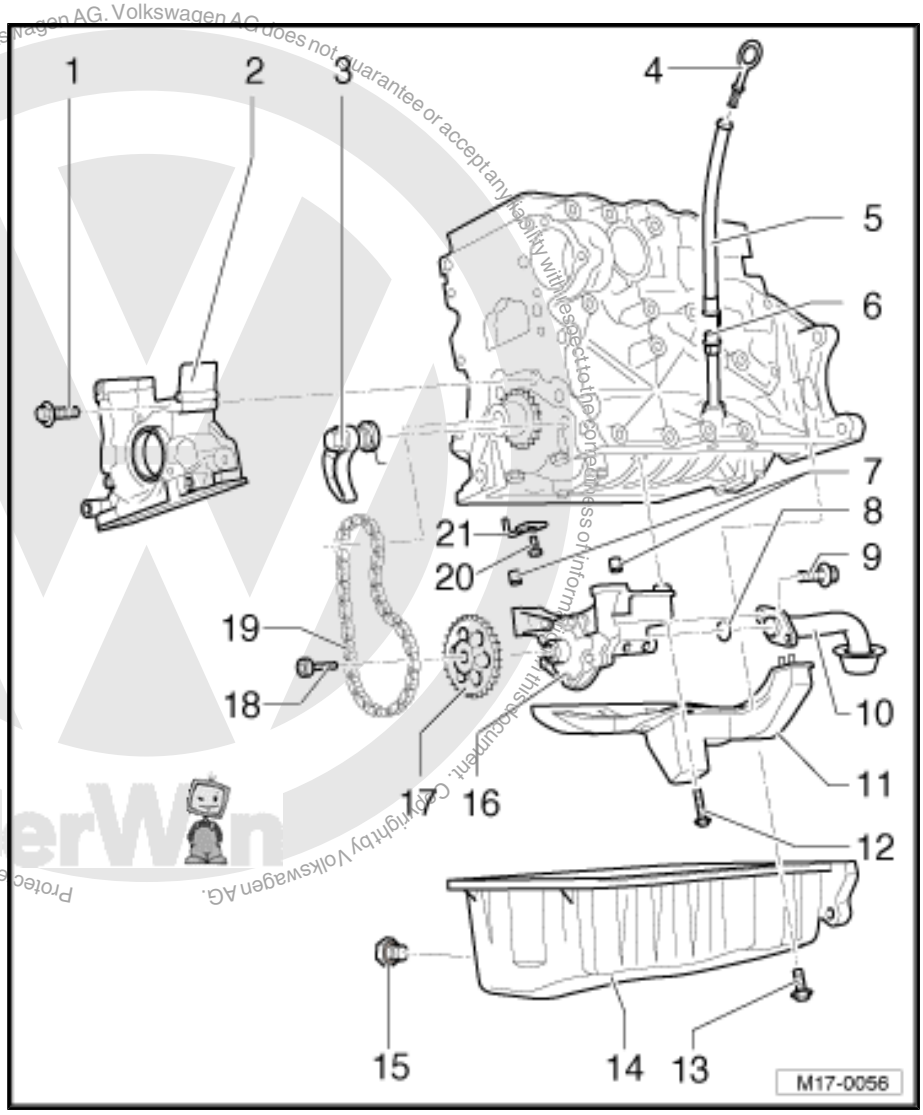
- ❑ Insert without sealant.

25 - Oil spray jet

- ❑ For piston cooling

Note

2.2 Oil pump, oil sump - assembly overview, engine codes BRM



1 - 15 Nm

2 - Sealing flange

- ❑ With oil seal
- ❑ Must seat on dowel sleeves.
- ❑ Removing and installing ⇒ page 35
- ❑ Install with silicone sealant -D 176 404 A2- ⇒ page 35
- ❑ Do not additionally oil or grease the oil seal sealing lip.
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ❑ Renewing crankshaft oil seal - belt pulley end- ⇒ page 33

3 - Chain tensioner with tensioning rail, 15 Nm

- ❑ When installing, pretension spring and engage

4 - Oil dipstick

- ❑ The oil level must not be above the max. mark!
- ❑ Markings ⇒ page 97

5 - Dipstick guide

6 - Guide tube

7 - Dowel sleeves

8 - O-ring

- ❑ Renew.

9 - 15 Nm

10 - Suction line

- ❑ Clean strainer if soiled

11 - Baffle plate

12 - 15 Nm

13 - 15 Nm

14 - Sump

- ❑ Clean sealing surface before installing
- ❑ Install with silicone sealant -D 176 404 A2-
- ❑ Removing and installing ⇒ page 101

15 - Oil drain plug, 30 Nm

- ❑ With attached seal.
- ❑ Renew.

16 - Oil pump

- ❑ With 12 bar pressure relief valve.
- ❑ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.
- ❑ Renew if running surfaces and gears are scored.

17 - Oil pump chain sprocket

18 - 20 Nm + 90° (1/4 turn) further

- ❑ Renew.

19 - Chain

20 - 25 Nm

- ❑ Insert without sealant.

21 - Oil spray jet

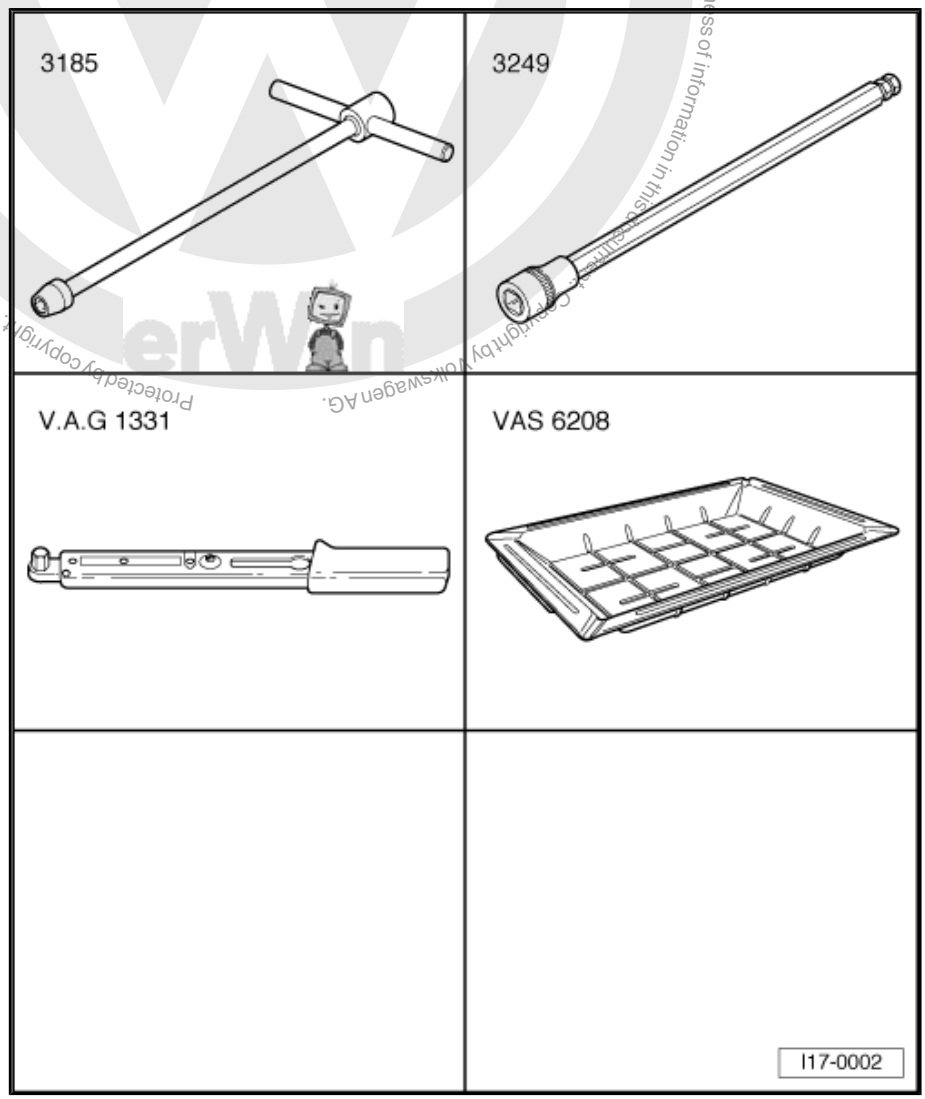
- ❑ For piston cooling

Note

2.3 Removing and installing sump

Special tools and workshop equipment required

- U/J extension and socket, 10 mm -3185-
- Tool insert 5 mm -3249-
- Torque wrench -V.A.G 1331-
- Drip tray for workshop hoist -VAS 6208 -
- Silicone sealant -D 176 404 A2-
- Hand drill with plastic brush attachment
- Eye protection
- Flat scraper



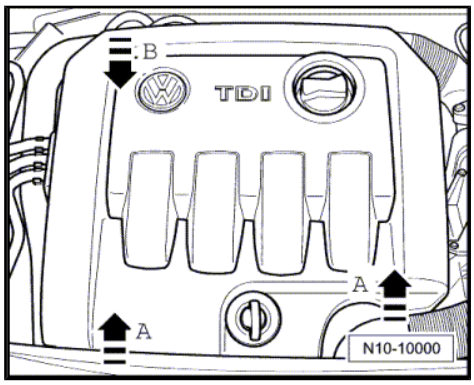
Removing ⇒ page 102

Installing ⇒ page 103

2.3.1 Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Remove intake hose air filter/exhaust turbocharger.

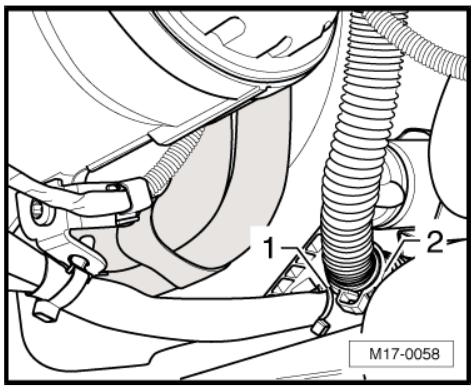


– Carefully cut through cable tie -1-.

Vehicles with engine codes BKC, BXE

– Open wiring retainer -2- and unhook wiring harness.

– Remove air filter housing with air mass meter and connecting pipe.



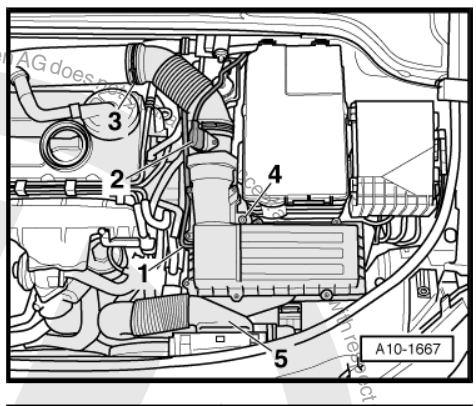
– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- and air duct hoses -3- and -5- off.

– Unscrew bolt -4- and take off air filter housing.

Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.



– Disconnect connector -2- on air mass meter -G70- .

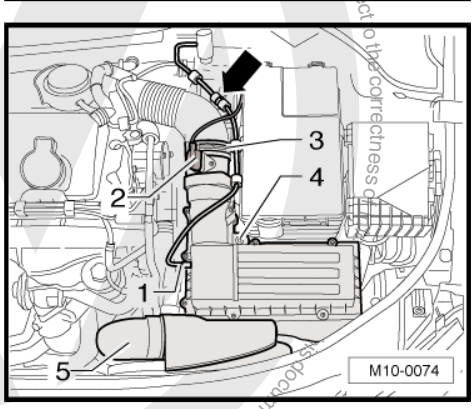
– Pull breather hose -1- off and unhook from bracket -arrow-.

– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .

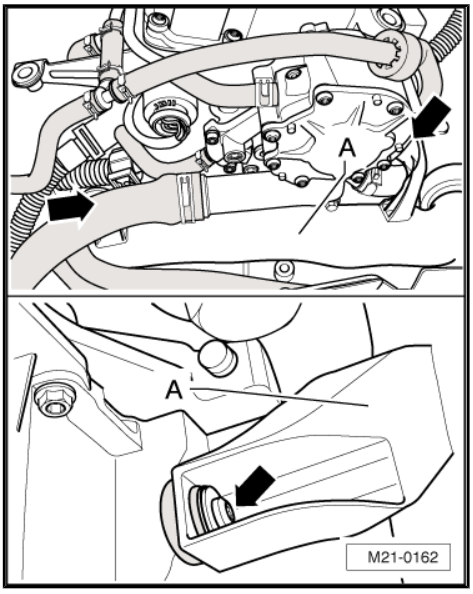
– Pull intake manifold -5- off the air duct.

– Unscrew bolt -4- and take off air filter housing.

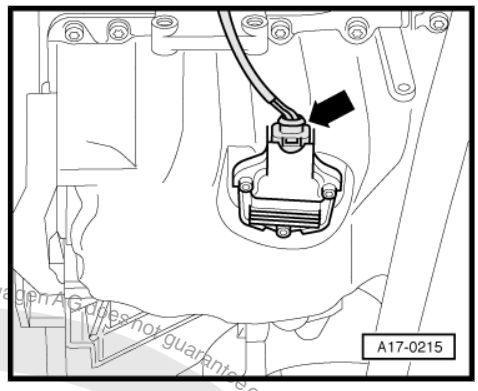
Continuation for all models



– Remove both bolts -arrows- from upper charge air pipe -A-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Remove the bolt -arrows- of the charge air pipe -A- from the oil sump.



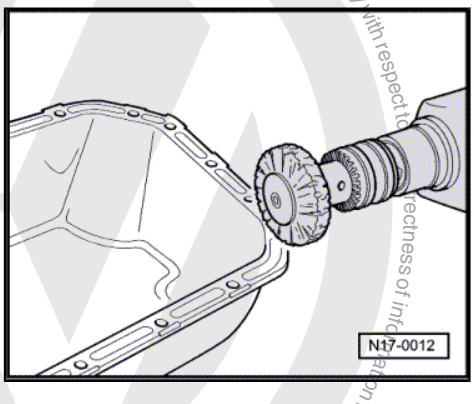
– If fitted, pull connector off oil level and oil temperature sender -G266- .
– Drain engine oil.



Note

Observe environmental regulations for disposal.

– Remove connecting bolts for sump and gearbox.
– Install sump bolts using 10 mm jointed wrench -3185- . (Remove using socket insert 5 mm -3249- .)
– Remove sump. Loosen sump with light blows of a rubber-headed hammer if necessary.
– Remove sealant residue on cylinder block with a flat scraper.
– Remove sealant residue on sump with a rotating brush, e.g. a hand drill with plastic brush attachment (wear eye protection).
– Clean the sealing surfaces. The sealing surfaces must be free of oil and grease.



2.3.2 Installing

Note

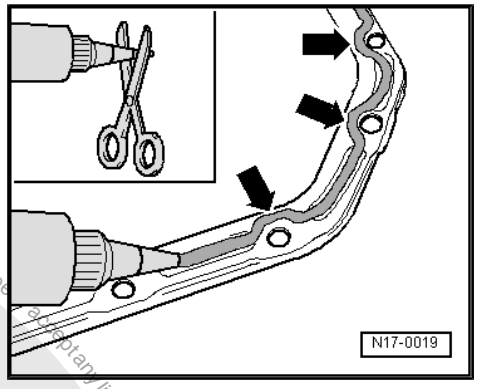
- *Observe the use-by date of the sealing compound.*
- *The sump must be installed within 5 minutes of applying silicone sealing compound.*

– Cut off tube nozzle at forward marking (approx. 3 mm nozzle ∅).

– Apply silicone sealing compound, as shown, to clean sealing surface on sump. Sealant bead -arrows- must be:

♦ 2...3 mm thick.

♦ Run bead along inner side of bolt holes -arrows-.



Note

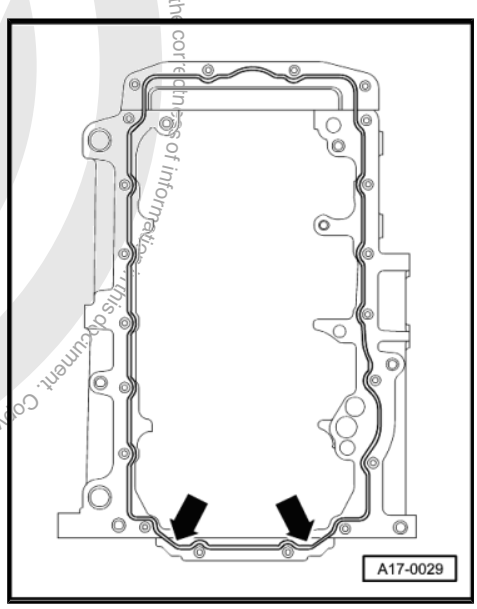
♦ *The sealing compound bead must not be thicker, otherwise excess sealing compound will enter the oil sump and may block the oil suction line strainer.*

♦ *If gearbox is removed, sump must align smoothly with cylinder block.*

♦ *If gearbox is installed, sump must rest against gearbox.*

– Apply silicone sealing compound bead as shown to the clean sealing surface of the sump. (The figure shows the position of the sealant bead on the cylinder block.)

– Install sump immediately and tighten all sump bolts lightly. Ensure that the oil sump is in flush with the intermediate plate/ gearbox flange.



Note

When installing sump with engine out of vehicle, ensure that sump is flush with cylinder block at flywheel end.

– Tighten sump bolts diagonally to 15 Nm.

– Tighten sump to gearbox bolts to 45 Nm.

Note

After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.

The rest of the assembly is basically a reverse of the dismantling sequence.

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

2.4 Removing and installing oil pump

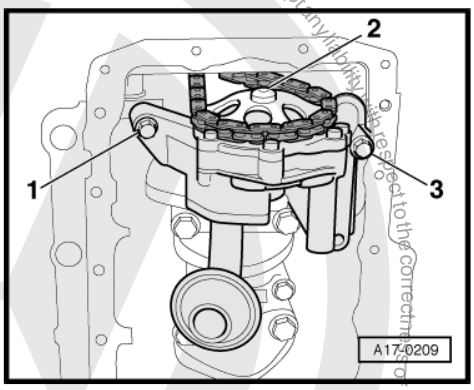
Removing ⇒ page 104

Installing ⇒ page 105

2.4.1 Removing

– Remove the oil sump and the baffle plate ⇒ page 101 .

– Remove bolts -2-.
– Pull sprocket off oil pump shaft.
– Remove bolts -1- and -3- and remove oil pump.



2.4.2 Installing

Install in reverse order. In the process, note the following:

– Insert dowel sleeves ⇒ Item 7 (page 100) on top of oil pump.

• Chain sprocket can only be fitted in one position on oil pump shaft.

– Install sump ⇒ page 101 .

Torque settings

Component	Nm
Sprocket to oil pump shaft	20 + 90°[1)]
Oil pump to cylinder block	15

1) Renew bolt.

3 Oil filter bracket, oil pressure, oil cooler and oil supply line

Oil filter bracket and oil cooler - Assembly overview ⇒ page 106

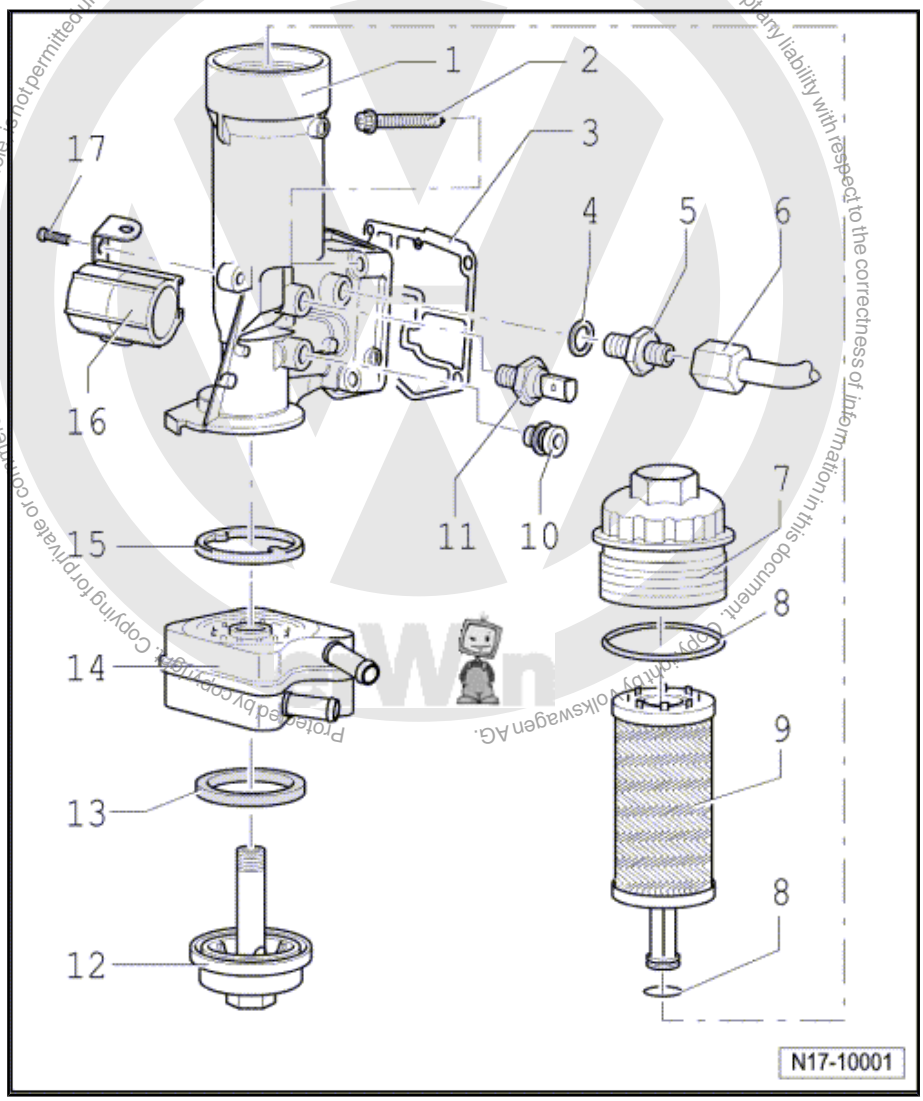
Removing and installing oil filter bracket and oil cooler ⇒ page 107

Checking oil pressure and oil pressure switch ⇒ page 112

Oil supply pipe to turbocharger - Assembly overview ⇒ page 113

Removing and installing oil supply line to turbocharger ⇒ page 114

3.1 Assembly overview - oil filter bracket and oil cooler



1 - Oil filter bracket

2 - 15 Nm + 90° (1/4 turn) further

- ❑ Renew.
- ❑ First fit upper left and lower right bolts and then tighten all four bolts diagonally.

3 - Seal

- ❑ Renew.

4 - Oil seal

- ❑ Renew.

5 - Pipe union, 35 Nm

6 - Oil supply line, 22 Nm

- ❑ To turbocharger
- ❑ Removing and installing ⇒ page 114 .

7 - Cap, 25 Nm

- ❑ Loosen and tighten with socket -T10125 -

8 - Oil seal

- ❑ Renew.

9 - Oil filter element

- ❑ Ensure that "Top" is uppermost when fitting.

10 - Plug, 10 Nm

- ❑ If sealing ring is leaking, nip open and renew.

11 - Oil pressure switch -F1-

- ❑ 0.7 bar switch: brown.
- ❑ Tighten to 20 Nm torque
- ❑ If sealing ring is leaking, nip open and renew.
- ❑ Checking ⇒ page 112 .

12 - Plug, 25 Nm

13 - Seal

- ❑ Renew.

14 - Oil cooler

- ❑ Ensure clearance to adjacent components.
- ❑ See note ⇒ page 98 .
- ❑ Checking oil cooler for leaks ⇒ page 140

15 - Seal

- ❑ Renew.

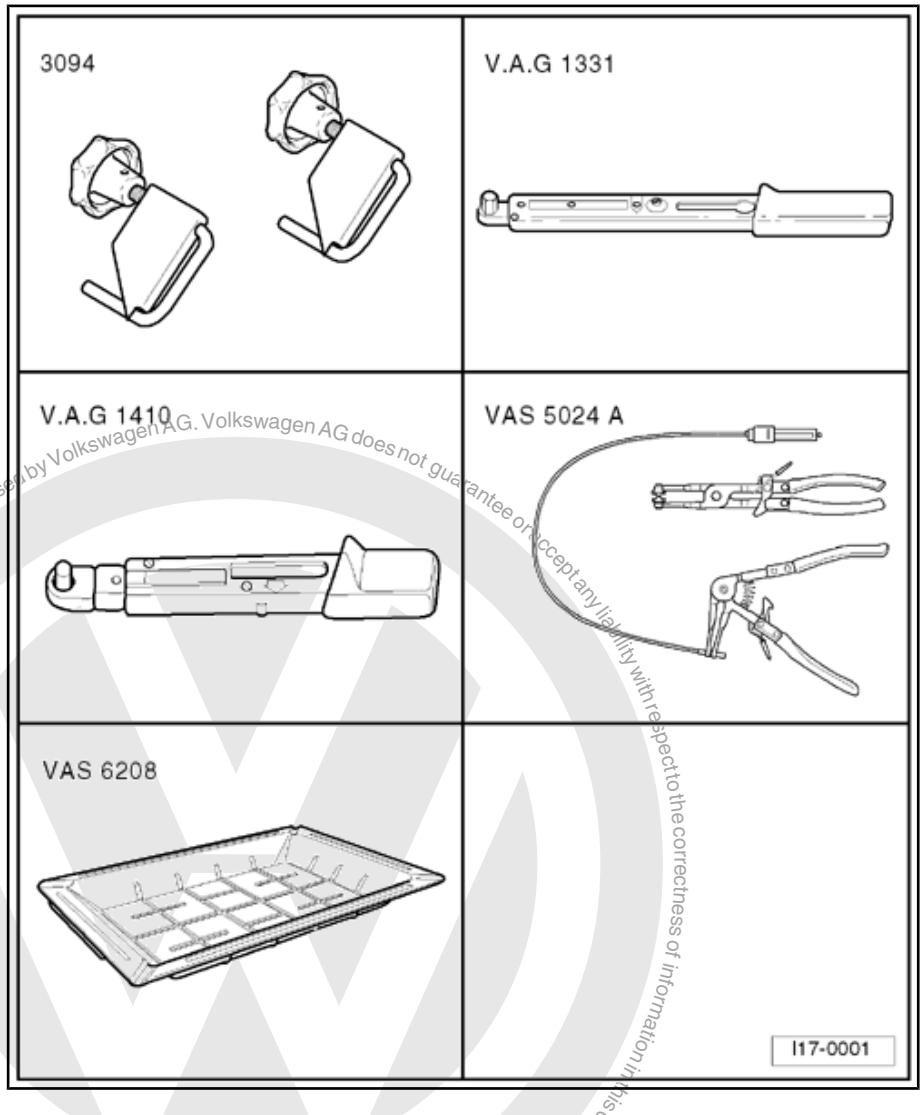
16 - Retainer

17 - 10 Nm

3.2 Removing and installing oil filter bracket with oil cooler

Special tools and workshop equipment required

- ♦ Hose clamps up to Ø 25 mm -3094-
- ♦ Torque wrench - V.A.G 1331-
- ♦ Torque wrench - V.A.G 1410-
- ♦ Spring-type clip pliers -VAS 5024A-
- ♦ Drip tray for workshop hoist -VAS 6208 -

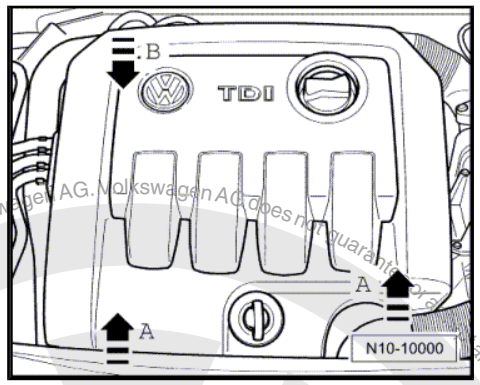


Removing ⇒ page 108

Installing ⇒ page 111

3.2.1 Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



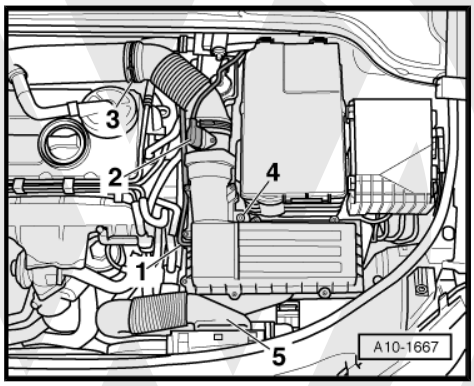
Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- and air duct hoses -3- and -5- off.

– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

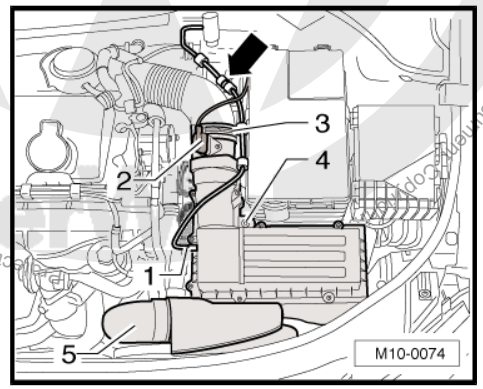
– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- off and unhook from bracket -arrow-.

– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .

– Pull intake manifold -5- off the air duct.

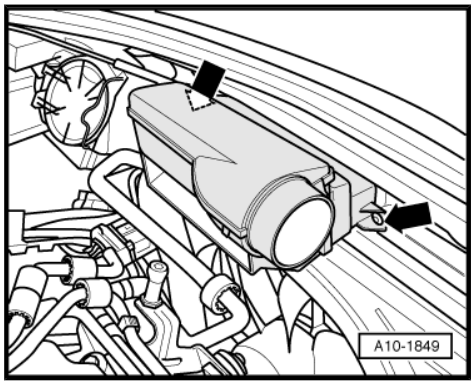
– Unscrew bolt -4- and take off air filter housing.



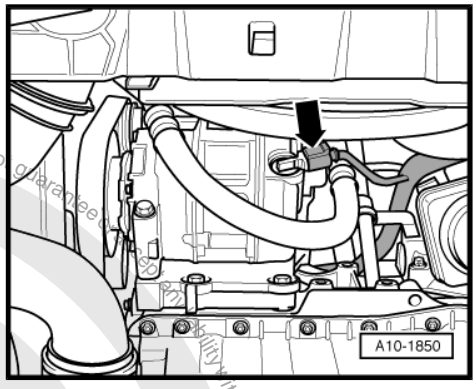
Continuation for all models

– Unbolt air duct from lock carrier -arrows-.

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .



– Disconnect connector -arrow- for magnetic coupling on air conditioner compressor.



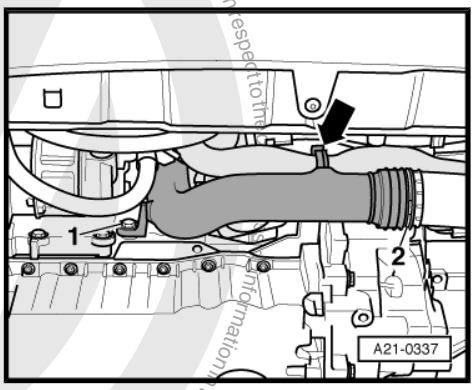
– Remove lower left air duct hose from front air duct pipe. To do this lift retaining clip -2- lightly.

Vehicles with engine codes BKC, BXE

– Remove bolts -1-.

– Unclip coolant hose on air duct pipe -arrow-.

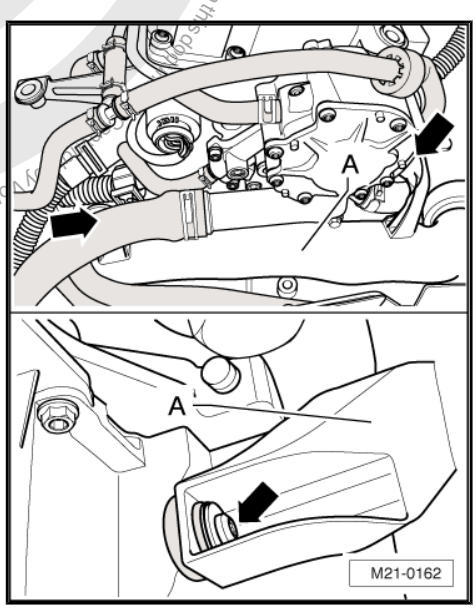
Vehicles with engine codes BLS, BRM



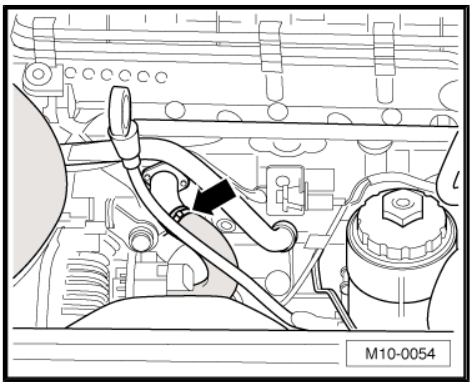
– Remove both bolts -arrows- from upper charge air pipe -A-.

– Remove the bolt -arrows- of the charge air pipe -A- from the oil sump.

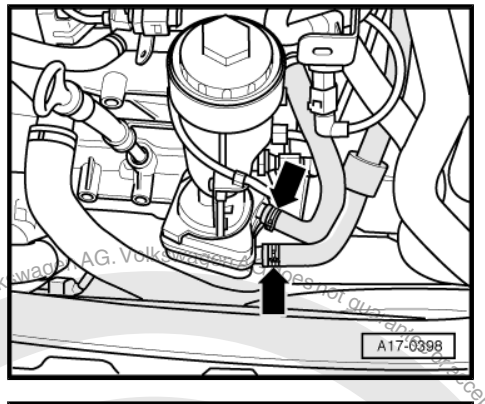
Continuation for all models



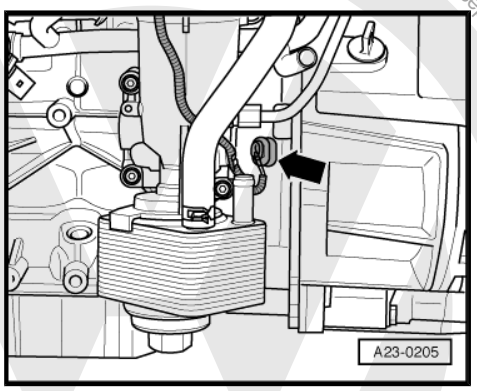
– Pull coolant hose -arrow- off.



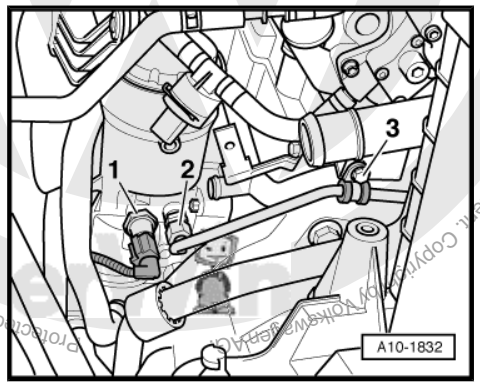
– Pull off or disconnect coolant hoses on oil cooler with hose clamps up to Ø 25 mm -3094- -arrows-.



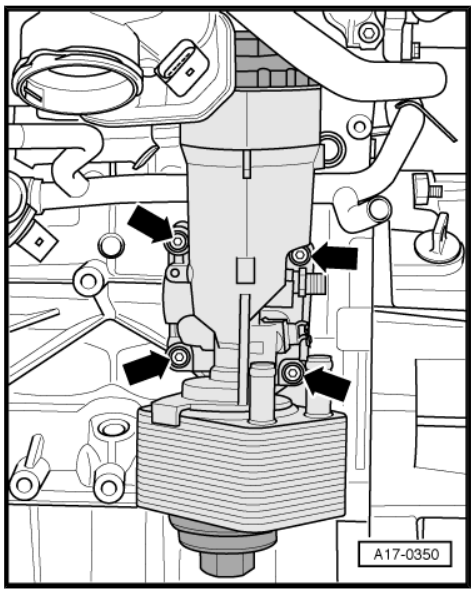
– Disconnect connector -arrow- on engine speed sender -G28- .
– Free wiring on wiring retainer.



– Disconnect connector on oil pressure switch -F1- -1-.
– Remove oil pressure switch -1-.
– Remove oil supply pipe to turbocharger on retainer -3- and on oil filter bracket -2-.



– Unscrew bolts -arrows-.
– Remove oil filter bracket.



3.2.2 Installing

Install in reverse order. In the process, note the following:

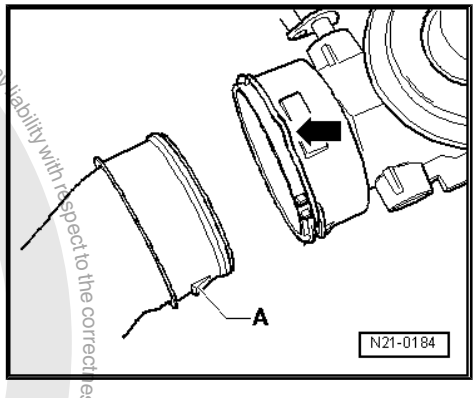
Note

- *Renew gaskets, seals and O-rings.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.

– Fill up cooling system if the oil cooler has been renewed (use fresh coolant if necessary) ⇒ page 127 .

– Fill up with engine oil and check oil level.



Torque settings

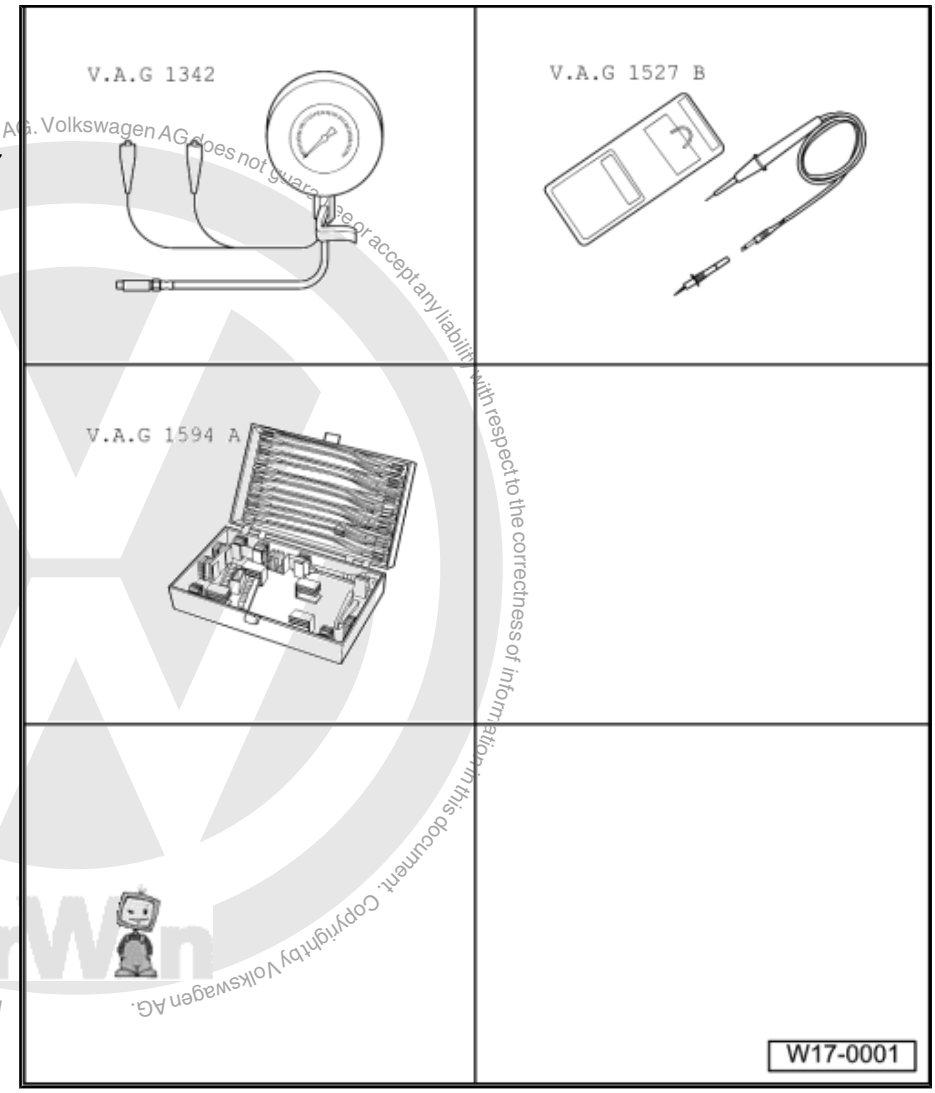
Component	Nm
Oil filter bracket to cylinder block	15 + 90°[2)]
Oil pressure switch to oil filter bracket	20
Oil supply pipe to oil filter bracket	22
Lower air duct pipe to cylinder block	15
Upper air duct pipe on retainer	8

2) Renew bolts.

3.3 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- Oil pressure tester -V.A.G 1342-
- Voltage tester -V.A.G 1527 B-
- Auxiliary measuring set -V.A.G 1594C-

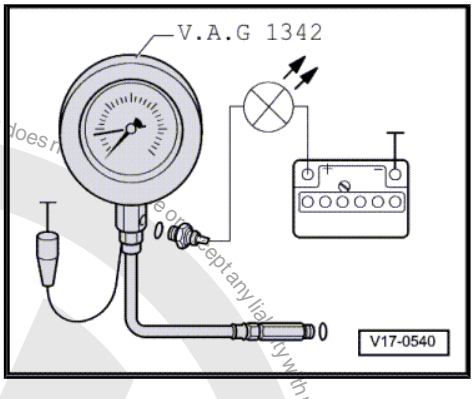


Test procedure

Note

Functional check and servicing the optical and acoustic oil pressure warning ⇒ Current flow diagrams, Electrical fault finding and Fitting locations,"Guided functions" with Vehicle diagnosis, testing and information system -VAS 5051B - .

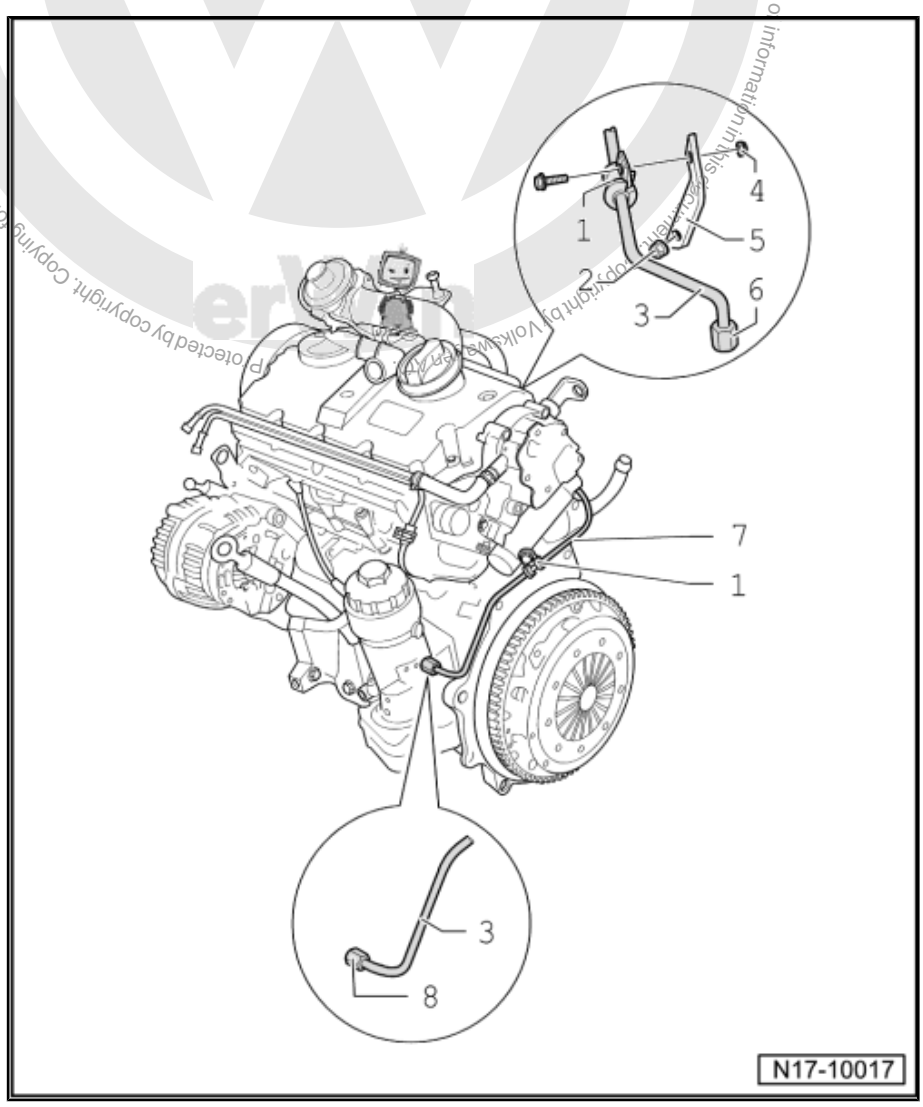
– Remove oil pressure switch -F1- and screw into tester.
– Screw tester into oil filter bracket in place of the oil pressure switch.
– Connect brown wire of tester to earth (-).
– Connect voltage tester -V.A.G 1527 B- using adapter cables from adapter set -V.A.G 1594C - to battery positive (+) and oil pressure switch. LED must not light up.
– Start engine and increase speed slowly.
– At 0.55...0.85 bar the LED must light up, otherwise renew oil pressure switch.
– Increase engine speed further. At 2000 $^{1}/_{min}$ and an oil temperature of 80°C the oil pressure should be min. 2.0 bar.



At higher engine speed, oil pressure must not exceed 7.0 bar. If necessary renew oil filter bracket.

3.4 Assembly overview - oil supply line to turbocharger

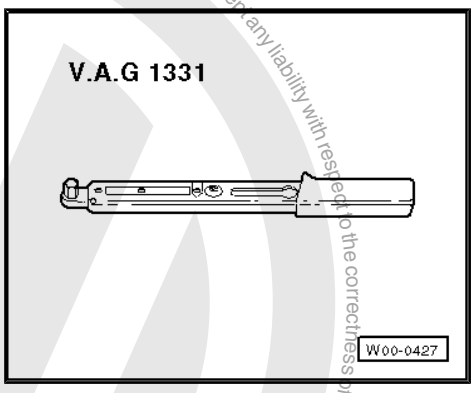
1 - Retaining clamp
2 - 25 Nm
3 - Oil supply line
❑ To turbocharger
4 - 10 Nm
5 - Retainer
6 - Union nut, 22 Nm
7 - 10 Nm
8 - Union nut, 22 Nm



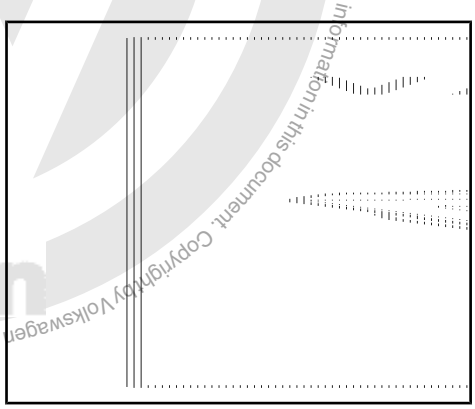
3.5 Removing and installing oil supply line to turbocharger

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



- Drip tray for workshop hoist -VAS 6208 -

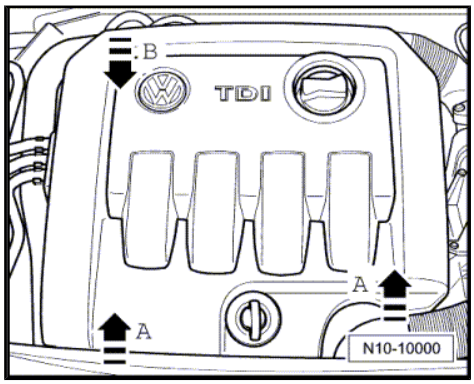


Removing ⇒ page 114

Installing ⇒ page 116

3.5.1 Removing

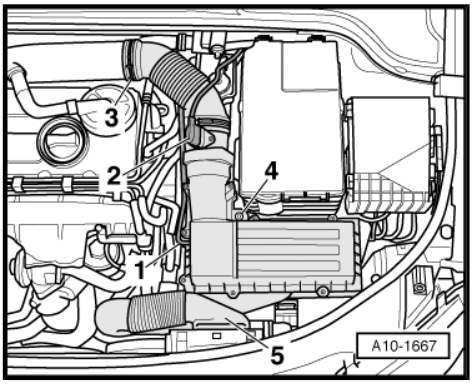
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

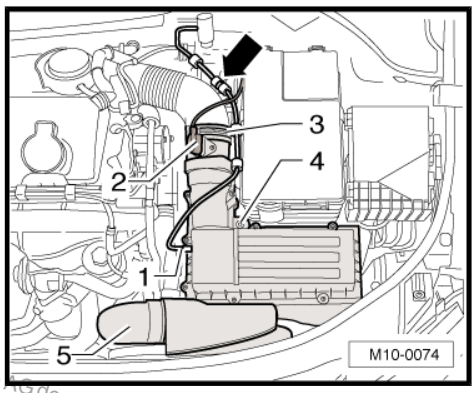
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- and air duct hoses -3- and -5- off.
– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

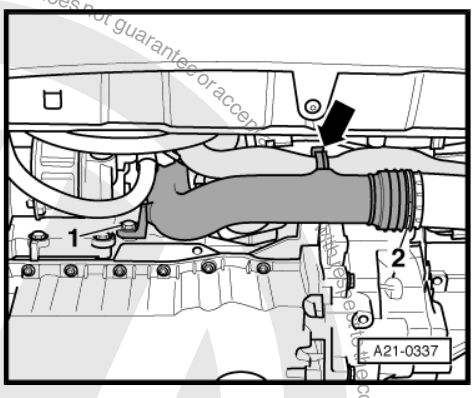
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.



Continuation for all models

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Remove lower left air duct hose from front air duct pipe. To do this lift retaining clip -2- lightly.

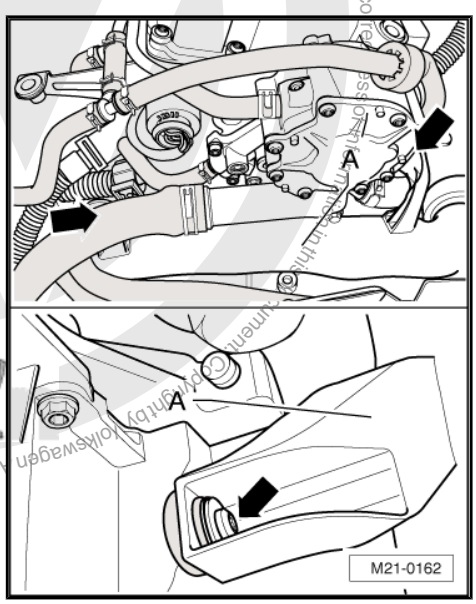


Vehicles with engine codes BKC, BXE

– Remove bolts -1-.
– Unclip coolant hose on air duct pipe -arrow-.

Vehicles with engine codes BLS, BRM

– Remove both bolts -arrows- from upper charge air pipe -A-.
– Remove the bolt -arrows- of the charge air pipe -A- from the oil sump.



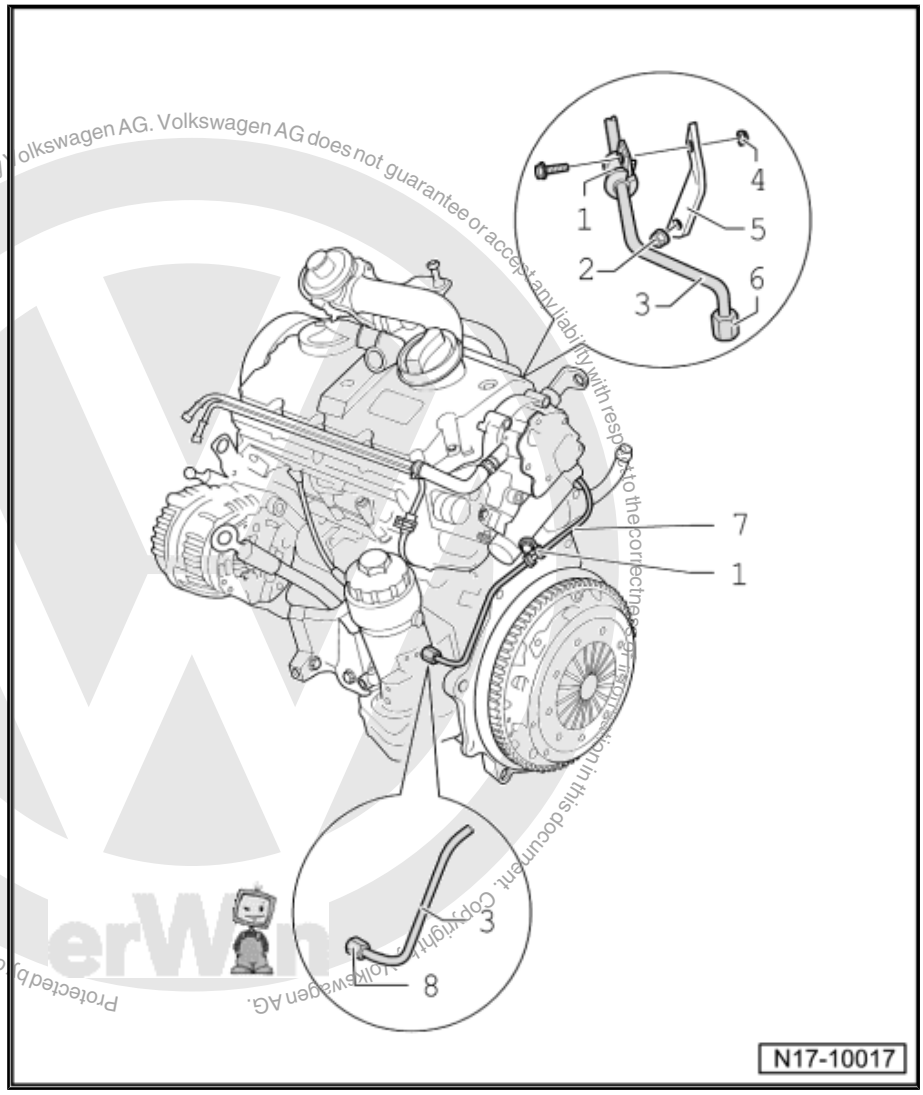
Continuation for all models

– Loosen securing bolts for retaining clips.
– Loosen oil supply line union nuts on oil filter bracket and turbocharger.
– Remove oil supply line.

3.5.2 Installing

Note

The procedure must be followed to ensure that oil supply line is installed tension-free.



– Loosen securing nut -2- on retainer -5-.
– Start union nuts for oil supply line on connections.
– Tighten union nut -8- on oil filter bracket hand-tight.
– Tighten union nut -6- on turbocharger hand-tight.
– First tighten union nut -8- on oil filter bracket and then union nut -6- on turbocharger to 22 m.
– Attach retaining clips -1- to brackets and tighten securing bolts to 10 Nm.
– Tighten securing nut -2- to 25 Nm.

Further installation is basically the reverse of the removal procedure.

19 – Cooling

1 Parts of the cooling system

WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.*
- *Ensure that there is sufficient clearance to all moving or hot components.*

Note

- *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips ⇒ Electronic parts catalogue "ETKA" .*
- *Spring-type clip pliers -VAS 5024A- or hose clip pliers -V.A.G 1921- are recommended for installation of spring-type clips.*
- *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- *Renew gaskets and seals.*
- *The arrows on the coolant pipes and on the ends of the hoses must be aligned with each other.*

Carry out leak test of cooling system with cooling system tester - V.A.G 1274- and the adapter -V.A.G 1274/8- and adapter - V.A.G 1274/9- .

Parts of cooling system - body side, engine codes BLS, BRM ⇒ page 118

Parts of cooling system - body side, engine codes BKC, BXE ⇒ page 119

Parts of cooling system - engine side, engine codes BLS, BRM ⇒ page 120

Parts of cooling system - engine side, engine codes BKC, BXE ⇒ page 123

Coolant hose schematic diagram ⇒ page 125

Draining and filling coolant ⇒ page 127

Removing and installing radiator fan - V7- and radiator fan 2 - V177- ⇒ page 130

Removing and installing radiator ⇒ page 132

Removing and installing coolant pump ⇒ page 134

Removing and installing thermostat ⇒ page 136

Checking cooling system for leaks ⇒ page 138

Checking oil cooler for leaks ⇒ page 140

1.1 Parts of cooling system - body side, engine codes BLS, BRM

1 - Radiator

- ❑ Removing and installing ⇒ page 132 .
- ❑ If renewed, change coolant in entire system.

2 - O-ring

- ❑ Renew if damaged.

3 - Coolant hose (top)

- ❑ Coolant hose schematic diagram ⇒ page 125 .

4 - Cap

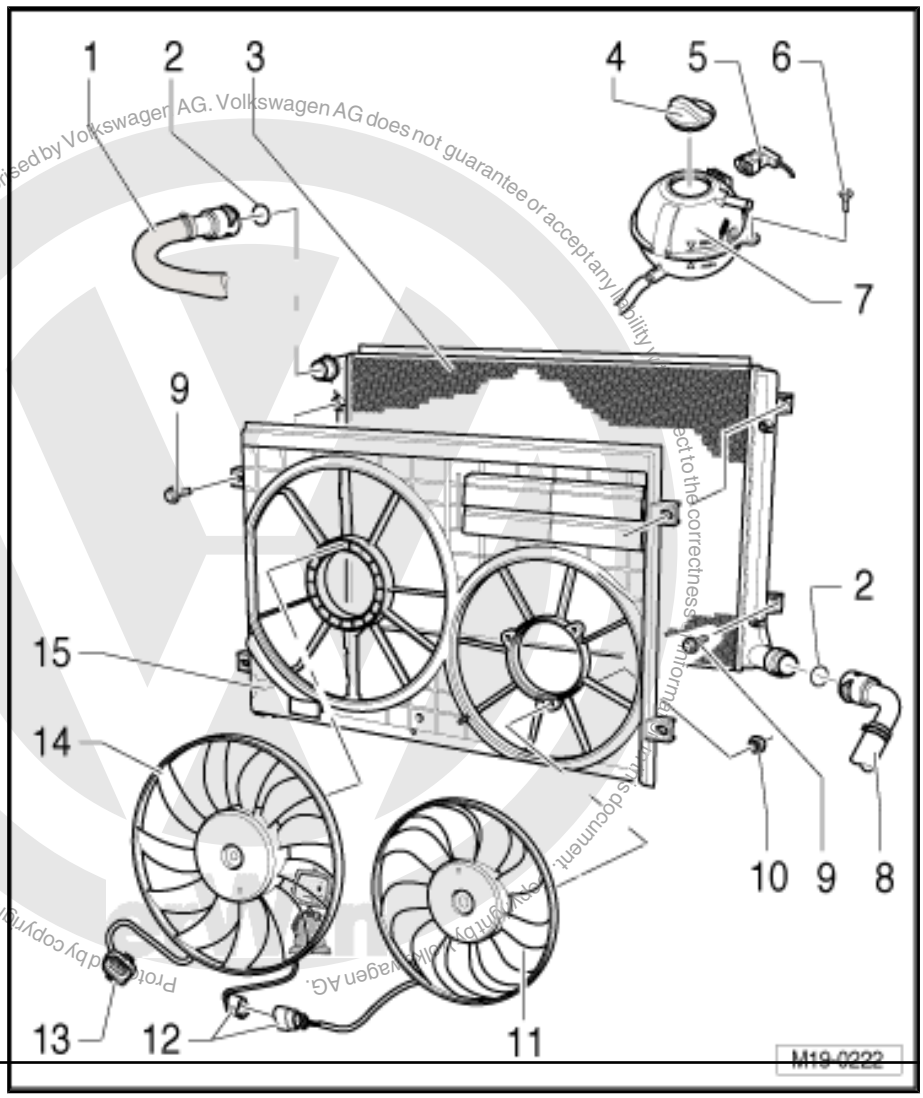
- ❑ Check with cooling system tester -V.A.G 1274 - and adapter for cap - V.A.G 1274/9- ⇒ page 139
- ❑ Test pressure: 1.4...1.6 bar.

5 - Connector

6 - 3 Nm

7 - Expansion tank

- ❑ With coolant temperature display sender - G32-
- ❑ Check with cooling system tester -V.A.G 1274 - and adapter - V.A.G 1274/8- ⇒ page 138



8 - Lower coolant hose

- ❑ Coolant hose schematic diagram ⇒ page 125 .

9 - 5 Nm

10 - 5 Nm

11 - Radiator fan 2 -V177-

- ❑ Only vehicles with optional equipment.
- ❑ Removing and installing ⇒ page 130 .

12 - Connector

13 - Connector

14 - Radiator fan -V7-

- ❑ With radiator fan control unit -J293-
- ❑ Removing and installing ⇒ page 130 .

15 - Cowling

1.2 Parts of cooling system - body side, engine codes BKC, BXE

1 - Coolant hose (top)

- ❑ Coolant hose schematic diagram ⇒ page 125 .

2 - O-ring

- ❑ Renew if damaged.

3 - Radiator

- ❑ Removing and installing ⇒ page 132 .
- ❑ If renewed, change coolant in entire system.

4 - Cap

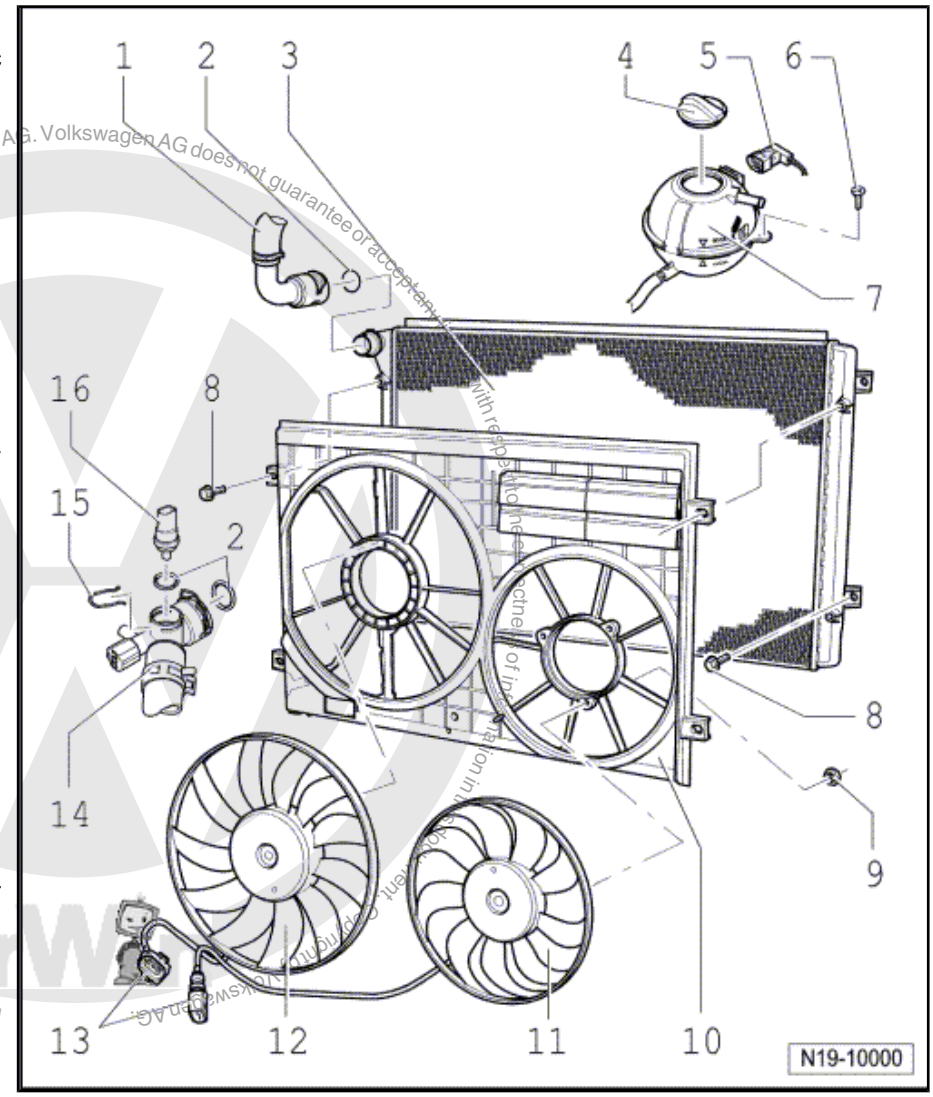
- ❑ Check with cooling system tester -V.A.G 1274- and adapter for cooling system -V.A.G 1274/9- ⇒ page 139
- ❑ Test pressure: 1.4...1.6 bar

5 - Connector

6 - 3 Nm

7 - Expansion tank

- ❑ With coolant temperature display sender -G32-
- ❑ Check with cooling system tester -V.A.G 1274 - and adapter -V.A.G 1274/8- ⇒ page 138



8 - 5 Nm

9 - 5 Nm

10 - Fan support

11 - Radiator fan 2 -V177-

- ❑ Only vehicles with optional equipment.
- ❑ Removing and installing ⇒ page 130 .

12 - Radiator fan -V7-

- ❑ With radiator fan control unit -J293-
- ❑ Removing and installing ⇒ page 130 .

13 - Connector

14 - Lower coolant hose

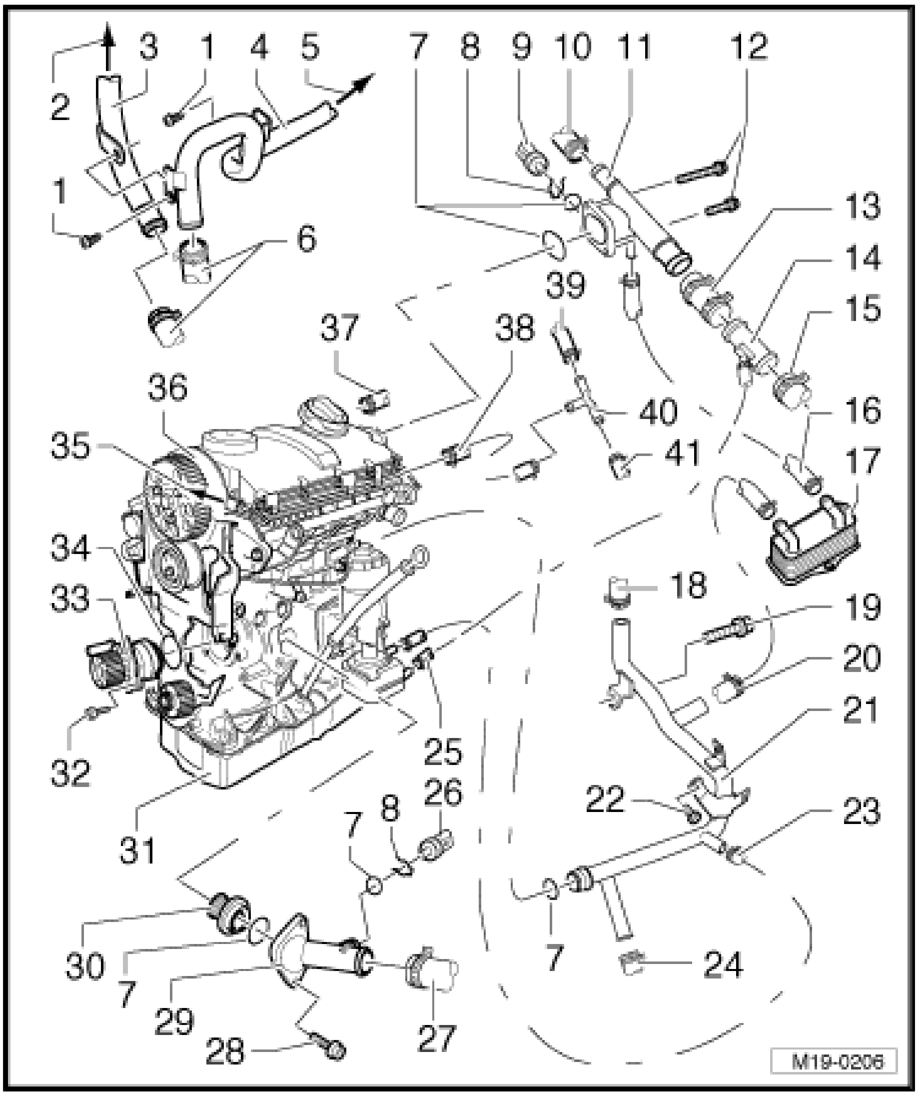
- ❑ Coolant hose schematic diagram ⇒ page 125 .

15 - Securing clip

- ❑ Check for secure seating.

16 - Radiator outlet coolant temperature sender -G83-

1.3 Parts of cooling system - engine side, engine codes BLS, BRM



1 - 10 Nm

2 - To exhaust gas recirculation cooler

- ❑ Coolant hose schematic diagram ⇒ page 125 .

3 - Coolant pipe

- ❑ Coolant hose schematic diagram ⇒ page 125 .

4 - Coolant pipe

- ❑ Coolant hose schematic diagram ⇒ page 125 .

5 - To heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 125 .

6 - To auxiliary heater

- ❑ Coolant hose schematic diagram ⇒ page 125 .

7 - O-ring

- ❑ Renew.

8 - Securing clip

- ❑ Check for secure seating.

9 - Coolant temperature sender -G62-

- ❑ With coolant temperature gauge sender -G2-

10 - To exhaust gas recirculation cooler

- ❑ Coolant hose schematic diagram ⇒ page 125 .

11 - Connection

12 - 10 Nm

13 - Connecting hose

14 - T-piece

15 - To top of radiator

- ❑ Coolant hose schematic diagram ⇒ page 125 .

16 - To gearbox oil cooler

- ❑ Vehicles with direct shift gearbox only
- ❑ Coolant hose schematic diagram ⇒ page 125 .

17 - Gearbox oil cooler

- ❑ Vehicles with direct shift gearbox only

18 - To heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 125 .

19 - 40 Nm

20 - From gearbox oil cooler

- ❑ Vehicles with direct shift gearbox only
- ❑ Coolant hose schematic diagram ⇒ page 125 .

21 - Coolant pipe

- ❑ Coolant hose schematic diagram ⇒ page 125 .

22 - 15 Nm

23 - Coolant hose

- ❑ To oil cooler for engine oil

24 - To bottom of expansion tank

- ❑ Coolant hose schematic diagram ⇒ page 125 .

25 - Coolant hose

- ❑ From oil cooler for engine oil to distributor piece ⇒ Item 14 (page 121)

26 - Radiator outlet coolant temperature sender -G83-

27 - To bottom of radiator

- ❑ Coolant hose schematic diagram ⇒ page 125 .

28 - 15 Nm

29 - Connection

- ❑ For thermostat.

30 - Thermostat

- ❑ Removing and installing ⇒ page 136 .
- ❑ Note installation position ⇒ page 136 .
- ❑ Checking: heat thermostat in water.
- ❑ Opening begins at approx. 85°C.
- ❑ Ends at approx. 105°C
- ❑ Opening lift min. 7 mm.

31 - Cylinder block

- ❑ With attachments

32 - 15 Nm

33 - Coolant pump

- ❑ Check for ease of movement
- ❑ Note installation position.

- ❑ Removing and installing ⇒ page 134 .

34 - O-ring

- ❑ Renew.
- ❑ Moisten with coolant before installing

35 - To top of expansion tank

- ❑ Coolant hose schematic diagram ⇒ page 125 .

36 - Cylinder head

- ❑ With attachments

37 - To bypass flap.

- ❑ Coolant hose schematic diagram ⇒ page 125 .

38 - Coolant hose

- ❑ From cylinder head to distributor piece ⇒ Item 40 (page 122)

39 - To bypass flap.

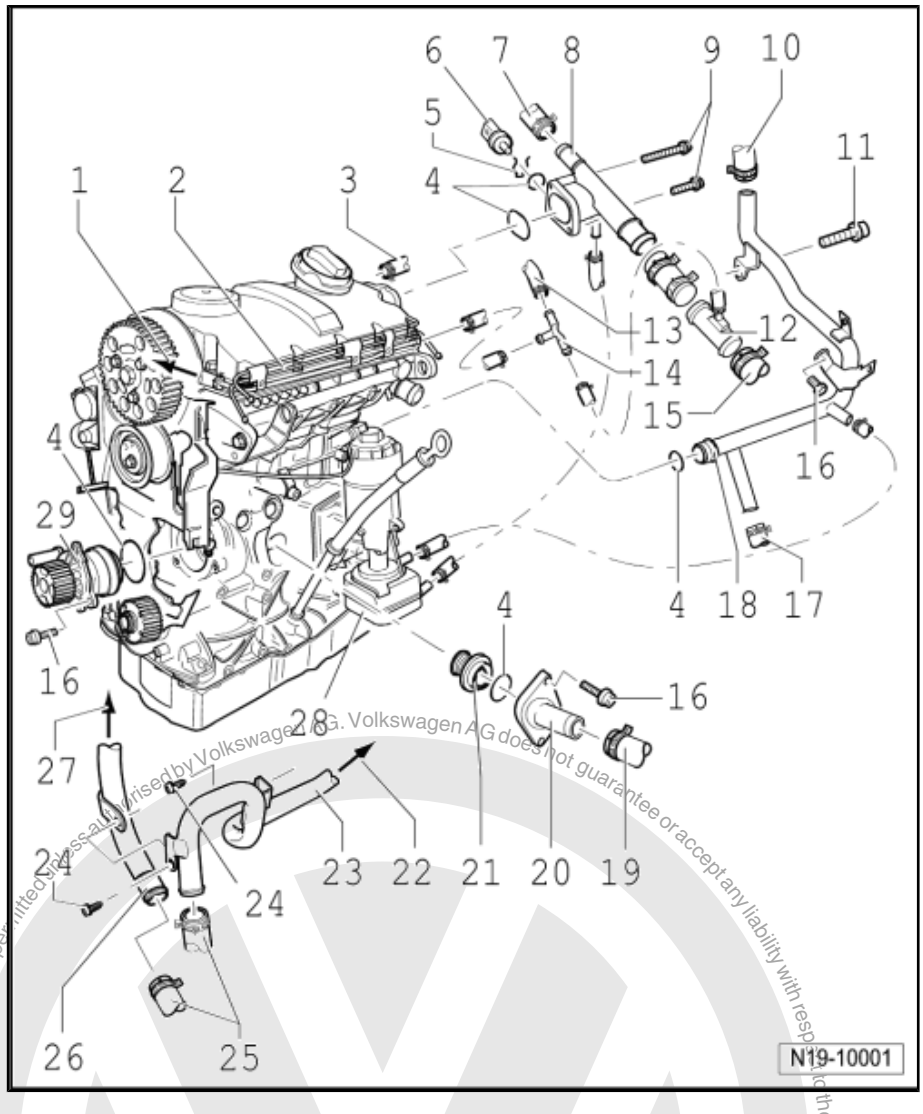
- ❑ Coolant hose schematic diagram ⇒ page 125 .

40 - T-piece

41 - To top of radiator

- ❑ Coolant hose schematic diagram ⇒ page 125 .

1.4 Parts of cooling system - engine side, engine codes BKC, BXE



1 - To top of expansion tank

- ❑ Coolant hose schematic diagram ⇒ page 125 .

2 - Coolant pipe (top)

- ❑ Bolted to cylinder head cover.

3 - To bypass flap.

- ❑ Coolant hose schematic diagram ⇒ page 125 .

4 - O-ring

- ❑ Renew.

5 - Securing clip

- ❑ Check for secure seating.

6 - Coolant temperature sender -G62-

- ❑ With coolant temperature gauge sender -G2-

7 - To exhaust gas recirculation cooler

- ❑ Coolant hose schematic diagram ⇒ page 125 .

8 - Connection

9 - 10 Nm

10 - To heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 125 .

11 - 40 Nm

12 - T-piece

13 - To bypass flap.

- ❑ Coolant hose schematic diagram ⇒ page 125 .

14 - T-piece

15 - To top of radiator

- ❑ Coolant hose schematic diagram ⇒ page 125 .

16 - 15 Nm

17 - To bottom of expansion tank

- ❑ Coolant hose schematic diagram ⇒ page 125 .

18 - Coolant pipe

19 - To bottom of radiator

- ❑ Coolant hose schematic diagram ⇒ page 125 .

20 - Connection

- ❑ For thermostat.

21 - Thermostat

- ❑ Removing and installing ⇒ page 136 .
- ❑ Note installation position ⇒ page 136 .
- ❑ Checking: heat thermostat in water.

- ❑ Opening begins at approx. 85°C.
- ❑ Ends at approx. 105°C
- ❑ Opening lift min. 7 mm.

22 - To heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 125 .

23 - Rear coolant pipe

24 - 10 Nm

25 - To auxiliary heater

- ❑ Coolant hose schematic diagram ⇒ page 125 .

26 - Coolant pipe

27 - To exhaust gas recirculation cooler

- ❑ Coolant hose schematic diagram ⇒ page 125 .

28 - Oil cooler

- ❑ Removing and installing ⇒ page 106 .

29 - Coolant pump

- ❑ Check for ease of movement
- ❑ Note installation position.
- ❑ Removing and installing ⇒ page 134 .

1.5 Coolant hose connection diagram

Connection diagram, engine codes BKC, BXE ⇒ page 125

Connection diagram for engine codes BLS, BRM ⇒ page 126

1.5.1 Connection diagram, engine codes BKC, BXE

1 - Expansion tank

2 - Bypass flap

3 - Exhaust gas recirculation cooler

4 - Heater unit heat exchanger

5 - Cylinder head/cylinder block

6 - Oil cooler

- ❑ For gear oil
- ❑ Only models with an automatic gearbox

7 - Coolant hose (top)

8 - Radiator

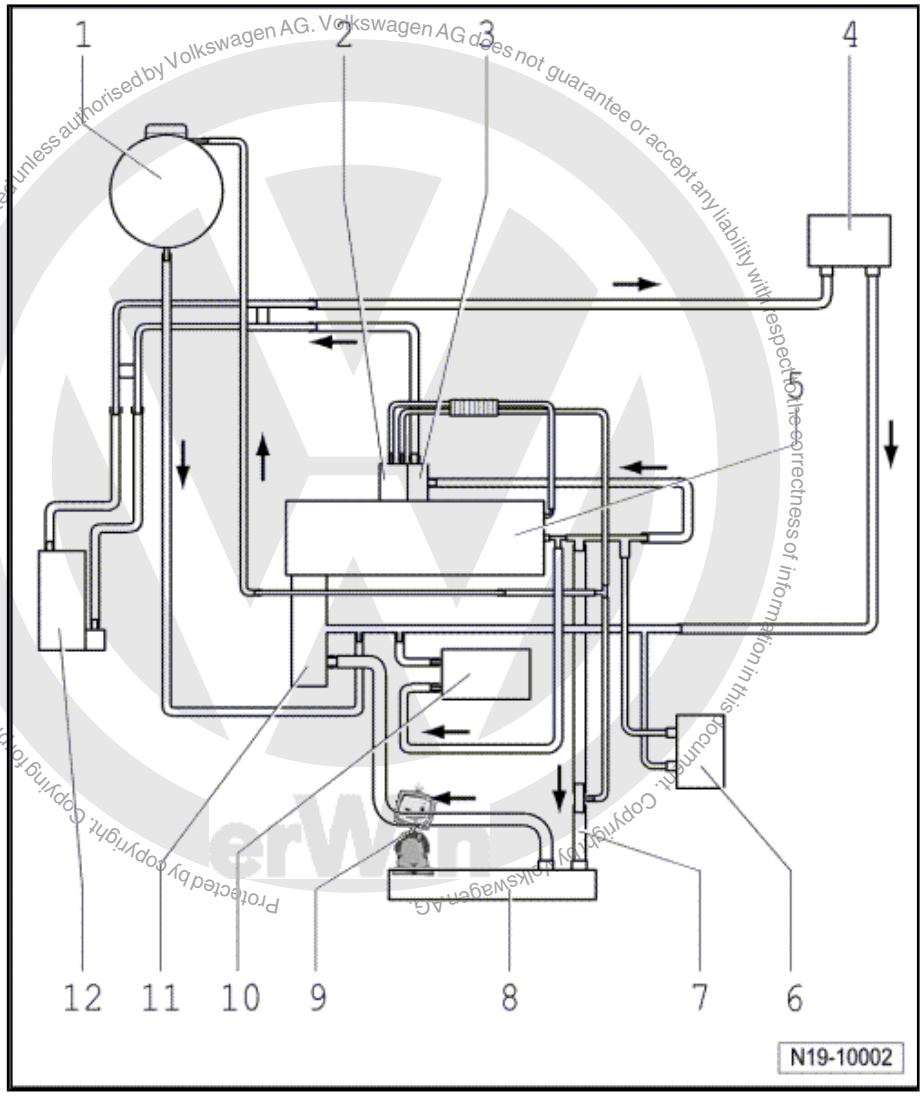
9 - Lower coolant hose

10 - Oil cooler

- ❑ For engine oil.

11 - Coolant pump and thermostat

12 - Auxiliary heater



1.5.2 Connection diagram, engine codes BLS, BRM

1 - Expansion tank

2 - Cylinder head/cylinder block

3 - Exhaust gas recirculation cooler

4 - Heater unit heat exchanger

5 - Oil cooler

- ❑ For automatic transmission fluid
- ❑ Only models with an automatic gearbox

6 - Coolant hose (top)

7 - Radiator

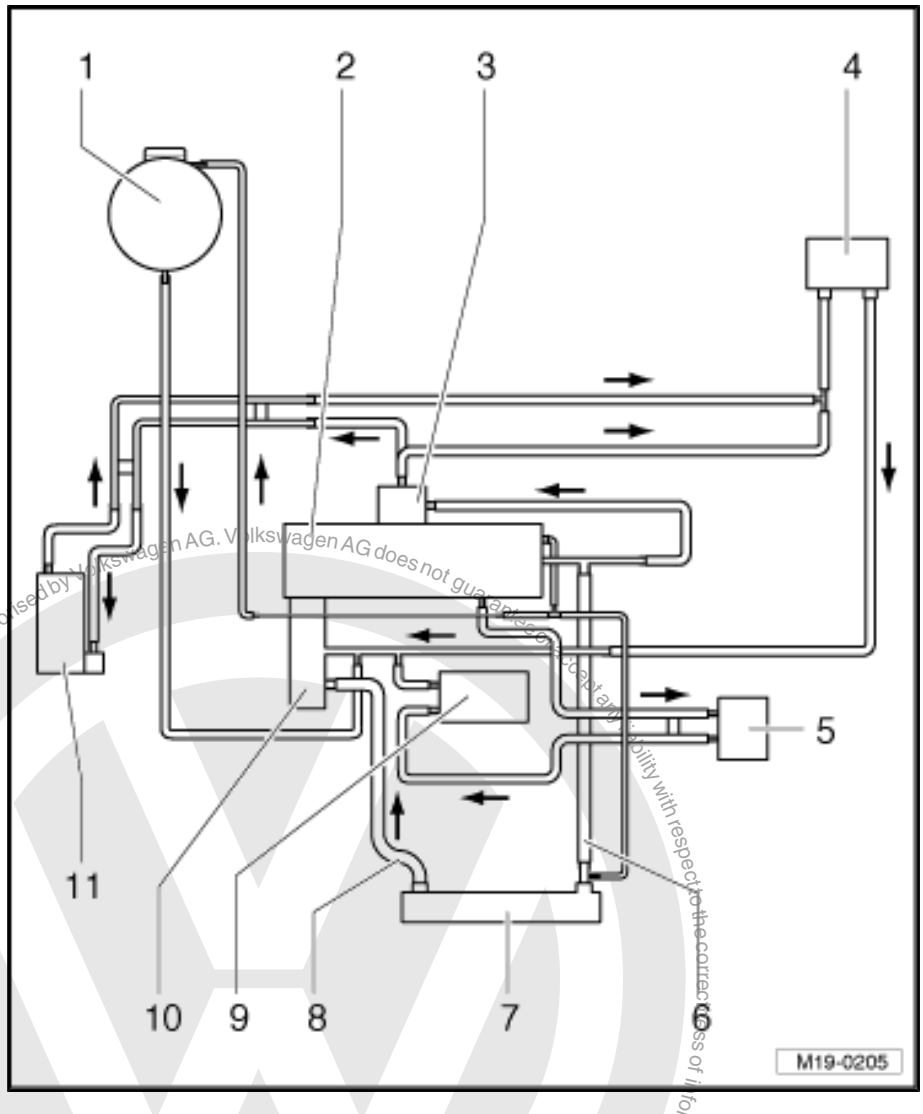
8 - Lower coolant hose

9 - Oil cooler

- ❑ For engine oil.

10 - Coolant pump and thermostat

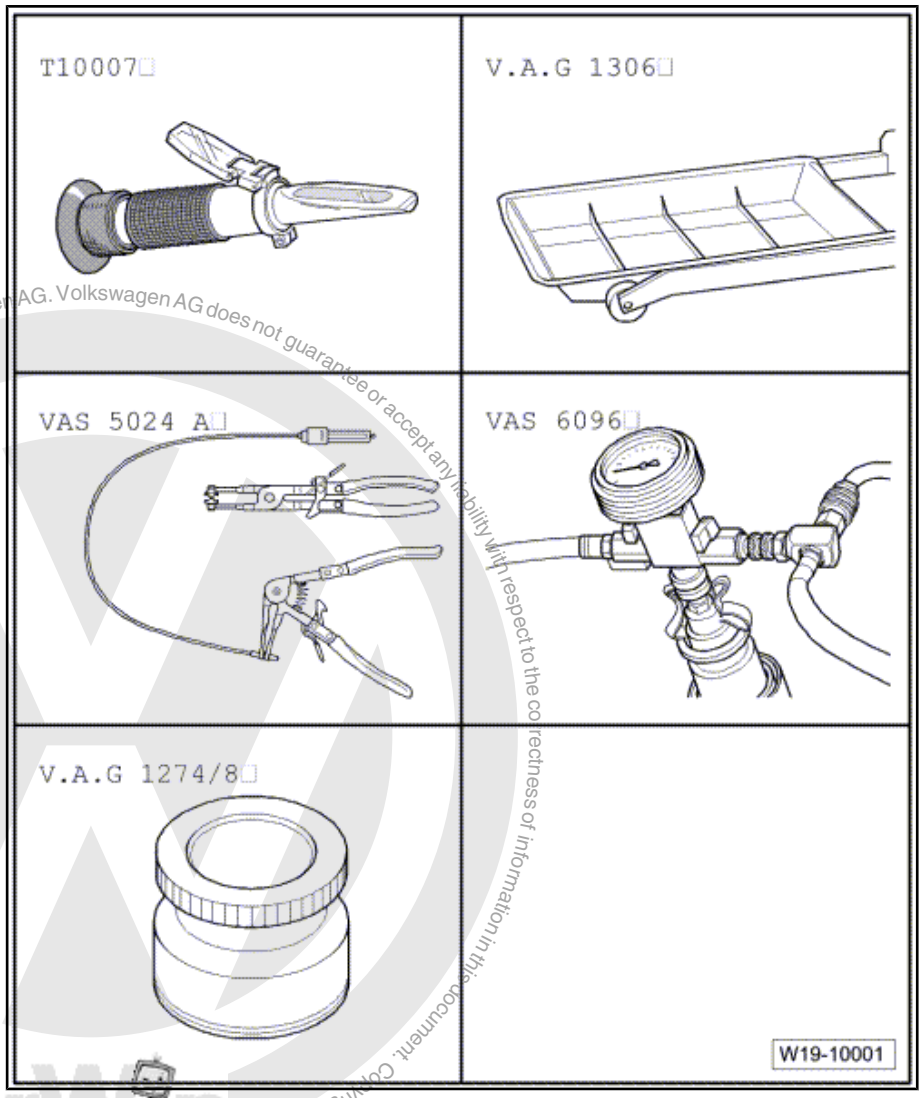
11 - Auxiliary heater



1.6 Draining and filling coolant

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- Spring-type clip pliers -VAS 5024A-
- Cooling system charge unit -VAS 6096 -
- Adapter -V.A.G 1274/8-



Draining ⇒ page 127

Filling ⇒ page 129

1.6.1 Draining

Note

- *Collect drained coolant in a clean container for re-use or disposal.*
- *Observe waste disposal regulations.*

WARNING

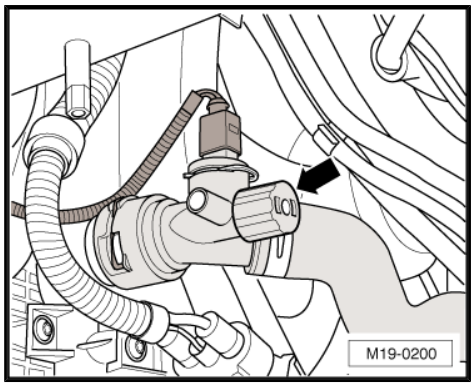
Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

– Open cap on coolant expansion tank.

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

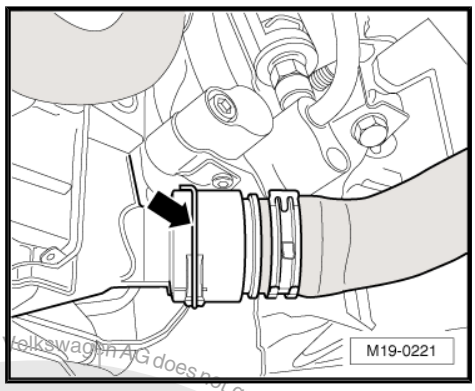
Vehicles with engine codes BKC, BXE

– To drain coolant from radiator, open drain plug -arrow-.



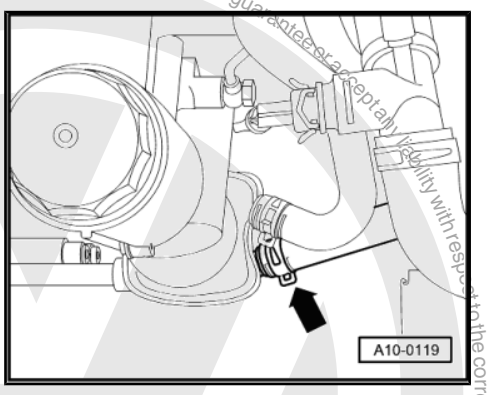
Vehicles with engine codes BLS, BRM

– Raise retaining clip -arrow- slightly and pull coolant hose from radiator.

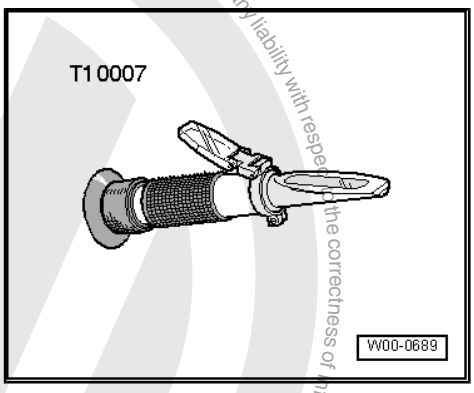


Continuation for all models

– To drain coolant from engine also remove coolant hose at oil cooler -arrow-.



1.6.2 Filling



Note

- *Only use coolant additive G 12 in accordance with TL VW 774 F. Identification: coloured lilac.*
- *G 12 purple (in accordance with TL VW 774 F) can be mixed with the previous coolant additive G 12 red!*
- *G 12 and coolant additives marked "In accordance with TL VW 774 F" prevent frost and corrosion damage, scaling and also raise boiling point of coolant. Therefore, the cooling system must be filled all year round with frost and corrosion protection additives.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection is required down to about -25°C (in countries with arctic climates: down to about -35°C).*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze percentage must be at least 40%.*
- *If for climatic reasons greater frost protection is required, the amount of G 12 can be increased, but only up to 60% (frost protection to about -40°C). Otherwise frost protection and cooling effectiveness are reduced again.*
- *The refractometer -T10007- is recommended to determine the freezing temperature of the coolant.*
- *If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.*

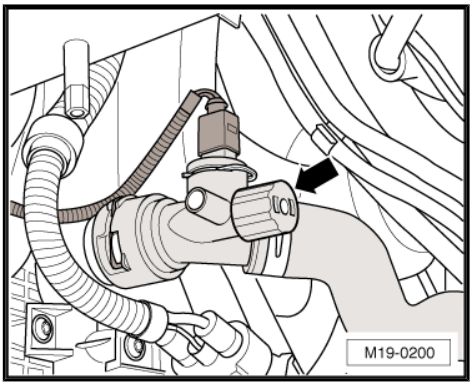
Recommended mixture proportions:

Frost protection to	Anti-freeze quantity	G 12[3)]	Water[3)]
-25°C	40%	3.2 l	4.8 l
-35°C	50%	4.0 l	4.0 l

3) The quantity of coolant can vary depending upon vehicle equipment.

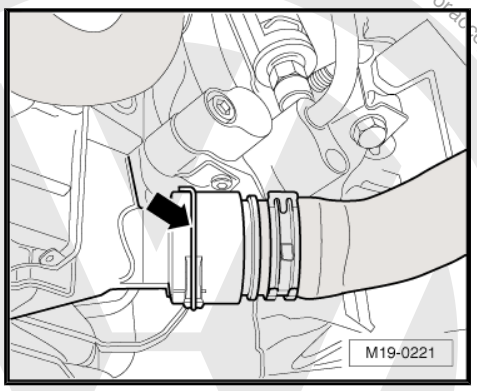
Vehicles with engine codes BKC, BXE

– Screw drain plug into radiator -arrow-.



Vehicles with engine codes BLS, BRM

– Fit coolant hose on radiator and lock retaining clip -arrow-.



Continuation for all models

– Connect coolant hoses to oil cooler.

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

Filling with cooling system charging unit -VAS 6096-

– Screw adapter for cooling system tester -V.A.G 1274/8- onto expansion tank.

– Fill coolant circuit using cooling system charging unit -VAS 6096- ⇒ manual for cooling system charging unit VAS 6096 .

Filling without cooling system charging unit -VAS 6096-

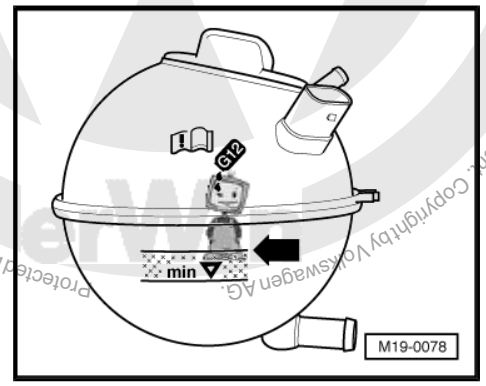
– Fill with coolant slowly up to upper marking of hatched field on expansion tank -arrow-.

– Fit expansion tank cap.

– Switch off heater and air conditioner.

– Start engine and maintain an engine speed of about 2000 rpm for approx. 3 minutes.

– Run engine until radiator fan cuts in.



WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

– Check coolant level and top-up if necessary.

♦ When the engine is at normal operating temperature the coolant level must lie on the upper marking of the hatched field -arrow-.

♦ On cold engine, coolant level should be roughly in middle of hatched area.

1.7 Removing and installing radiator fan -V7- and radiator fan 2 -V177-

Removing ⇒ page 130

Installing ⇒ page 131

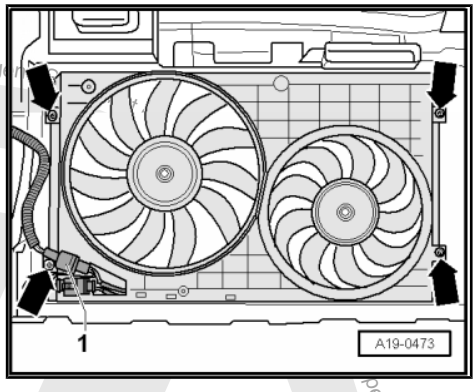
1.7.1 Removing

– Drain off coolant ⇒ page 127 .

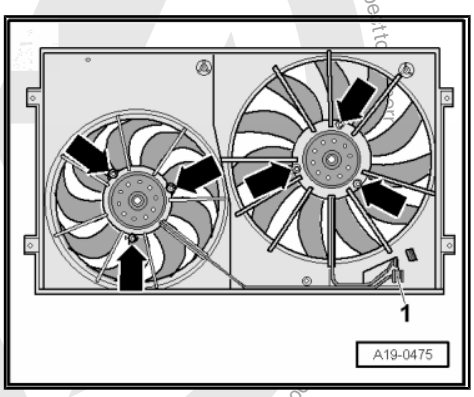
– Remove lower radiator connection (quick release coupling).

– Unclip lower coolant hose out of the air ducting.

– Disconnect connector -1- and remove securing bolts -arrows- of the air ducting.
– Remove cowling downwards.



– Separate connection -1- and free wiring. Installation position differs from the figure.
– Remove nuts -arrows- and remove fans.



1.7.2 Installing

Install in reverse order of removal. In the process, note the following:

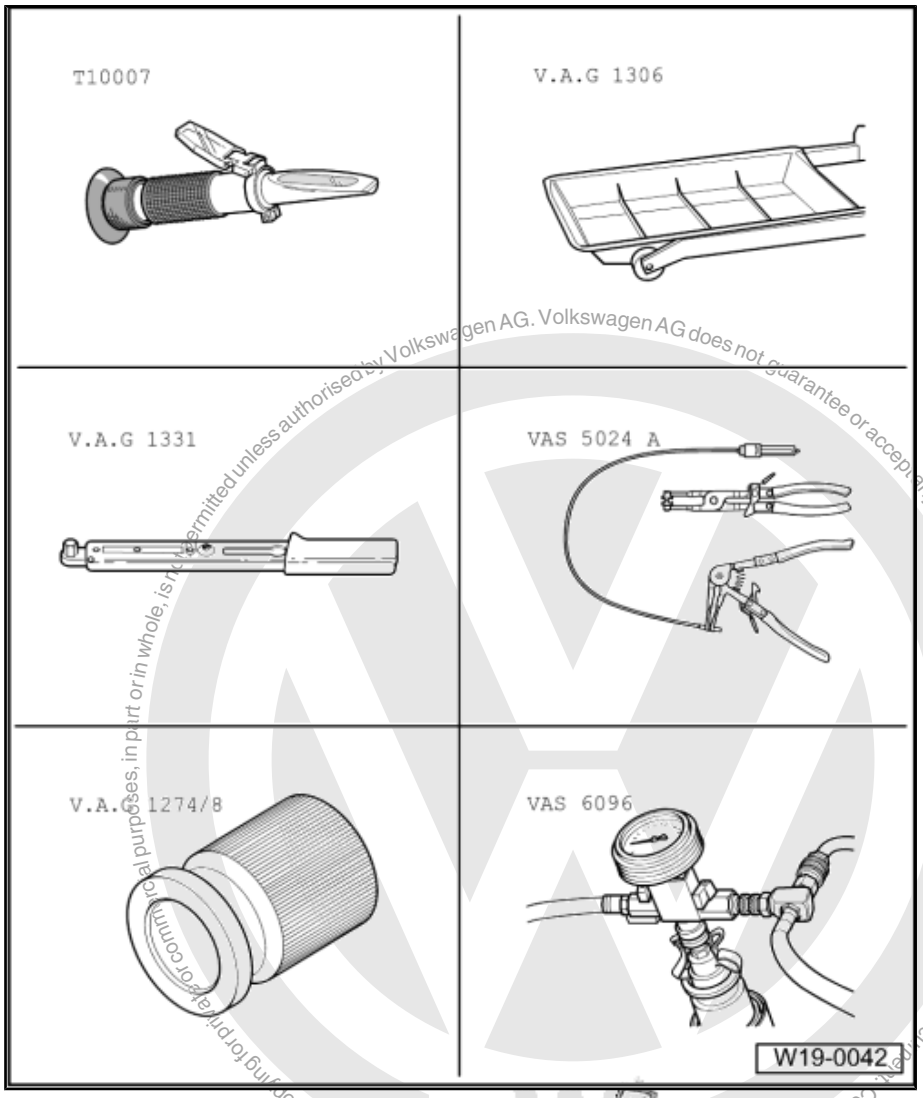
Torque settings:

Component	Nm
Radiator fan to cowling	5
Cowling to radiator	5

1.8 Removing and installing radiator

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- Torque wrench -V.A.G 1331-
- Spring-type clip pliers -VAS 5024A-
- Adapter set -V.A.G 1274/8-
- Cooling system charge unit -VAS 6096 -



Removing ⇒ page 132

Installing ⇒ page 133

1.8.1 Removing

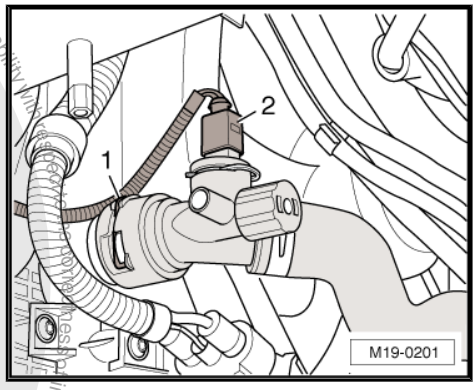
– Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. Gr. 50 ; Lock carrier .

– Drain off coolant ⇒ page 127 .

Vehicles with engine codes BKC, BXE

– Detach connector -2-.

– Remove coolant connection. To do this lift retaining clips -1- lightly.



Continuation for all models

– Disconnect coolant connection to upper radiator (quick release coupling).

– Remove cowling with radiator fans ⇒ page 130 .

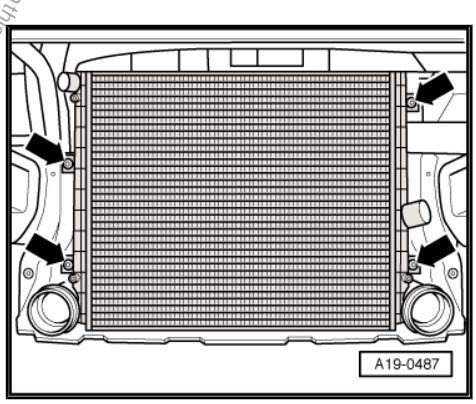
Note

To prevent damage to condenser or to refrigerant pipes and hoses, ensure that pipes and hoses are not stretched, kinked or bent.

– Remove bolts -arrows- from radiator mounting.

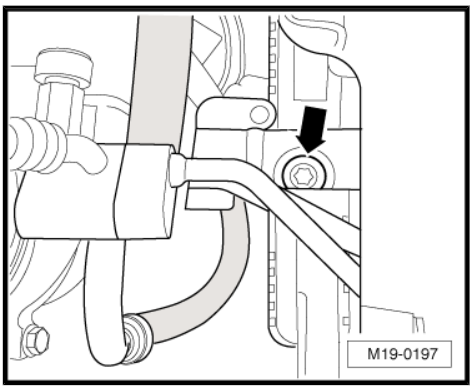
– Swing radiator slightly towards rear.

– Unscrew condenser securing bolts.



– Remove bolt -arrow- for fitting refrigerant pipe.

– Remove radiator downwards.



1.8.2 Installing

Install in reverse order. In the process, note the following:

♦ Renew coolant if a new radiator has been installed.

♦ Fill with coolant ⇒ page 127 .

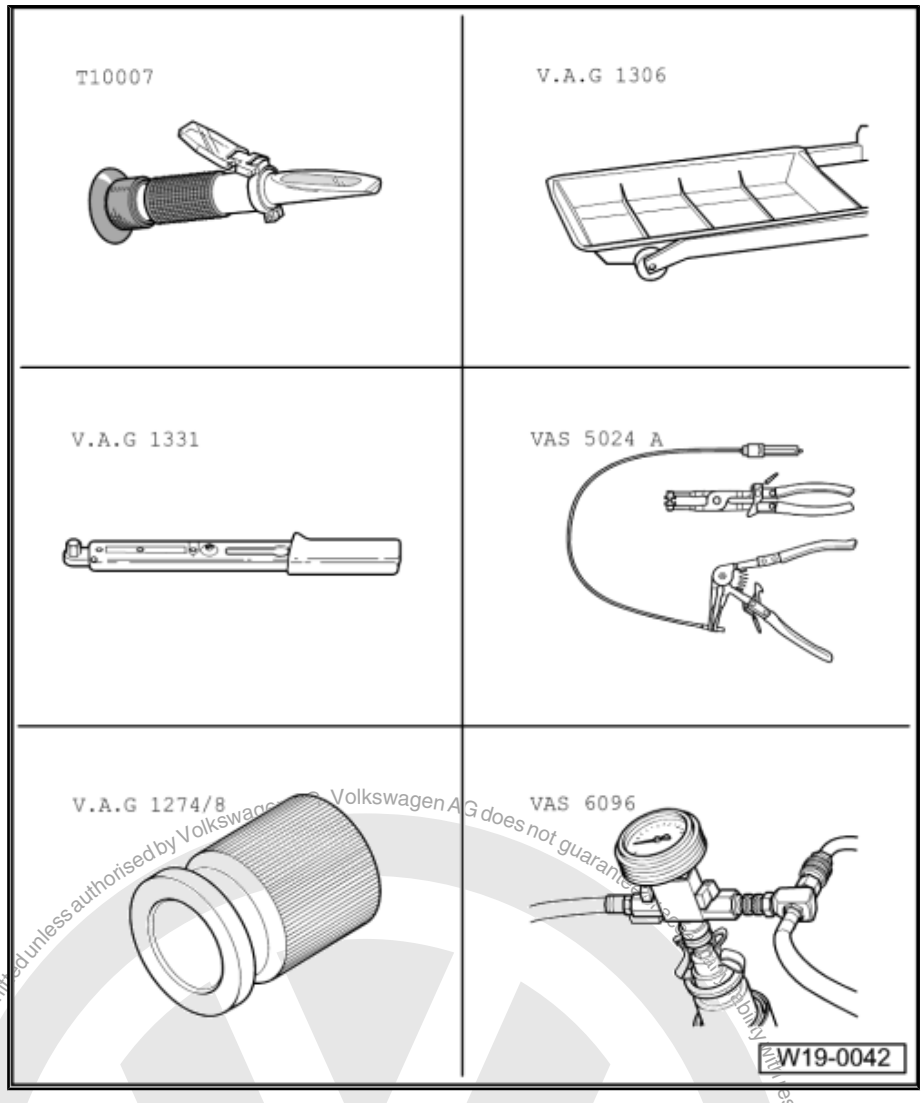
Torque settings:

Component	Nm
Radiator mounting to lock carrier	5
Condenser to radiator	5
Cowling to radiator	5

1.9 Removing and installing coolant pump

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- Torque wrench -V.A.G 1331-
- Spring-type clip pliers -VAS 5024A-
- Adapter set -V.A.G 1274/8-
- Cooling system charge unit -VAS 6096 -



Removing ⇒ page 134

Installing ⇒ page 135

1.9.1 Removing

Caution

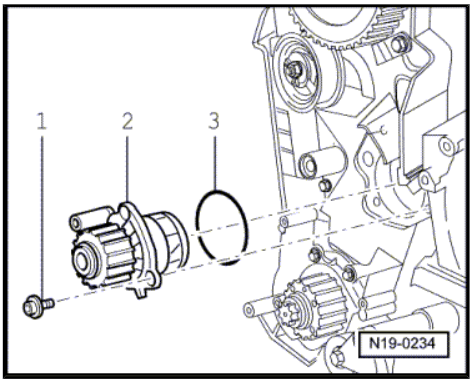
When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.*
- *To avoid damages to the wiring ensure sufficient clearance to all moving or hot components.*

Note

Always renew seals and gaskets.

– Drain off coolant ⇒ page 127 .
– Remove poly-V-belt ⇒ page 29 .
– Remove toothed belt ⇒ page 62 .
– Remove securing bolts -1- for coolant pump -2- and carefully remove coolant pump.



1.9.2 Installing

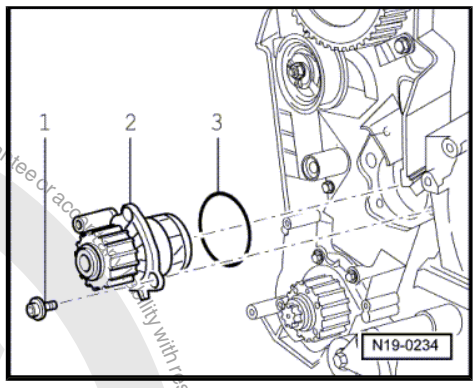
Install in reverse order. In the process, note the following:

– Moisten new O-ring -3- with coolant.

Note

The coolant pump plug faces downwards.

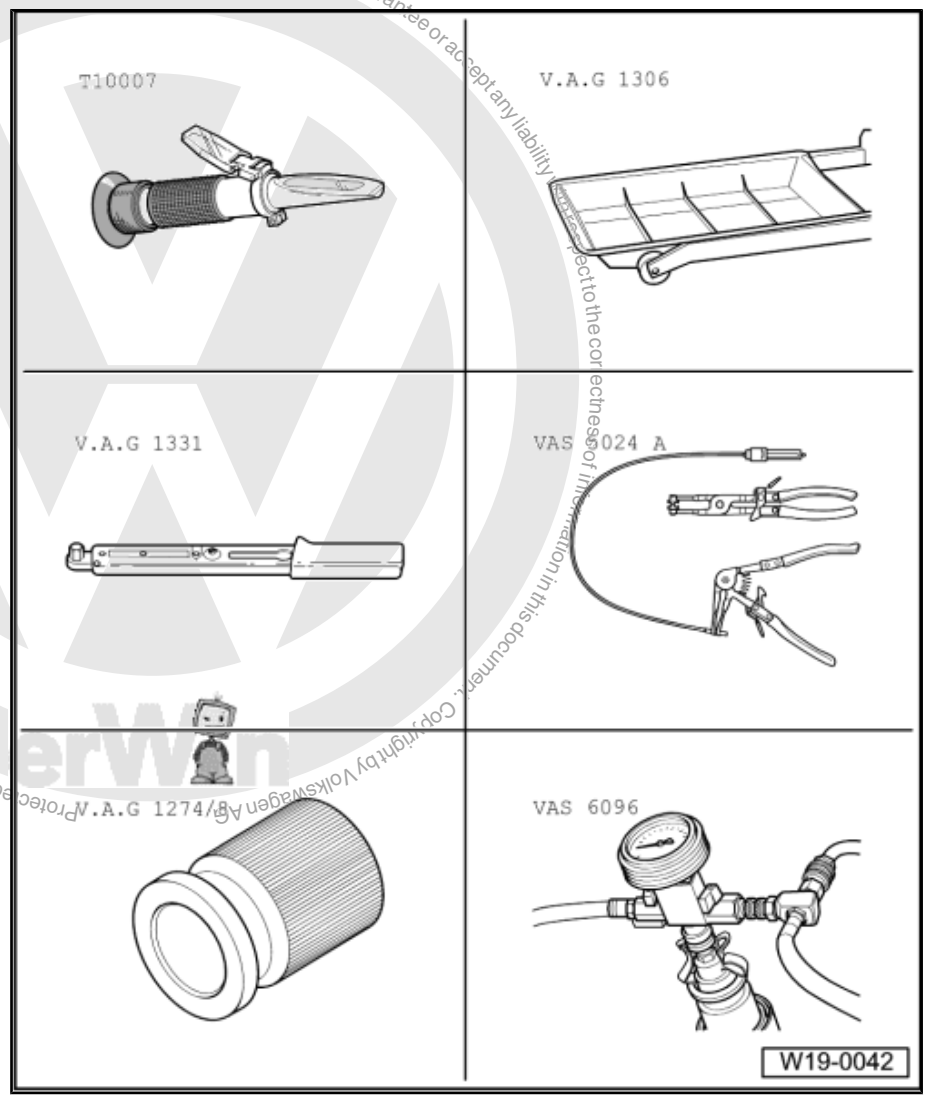
– Insert coolant pump -2- in cylinder block and tighten securing bolts -1- to 15 Nm.
– Install toothed belt ⇒ page 62 .
– Install poly-V-belt ⇒ page 29 .
– Fill coolant system with coolant ⇒ page 127 .



1.10 Removing and installing thermostat

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-
- Torque wrench -V.A.G 1331-
- Spring-type clip pliers -VAS 5024A-
- Adapter set -V.A.G 1274/8-
- Cooling system charge unit -VAS 6096 -



Removing ⇒ page 136

Installing ⇒ page 137

1.10.1 Removing

WARNING

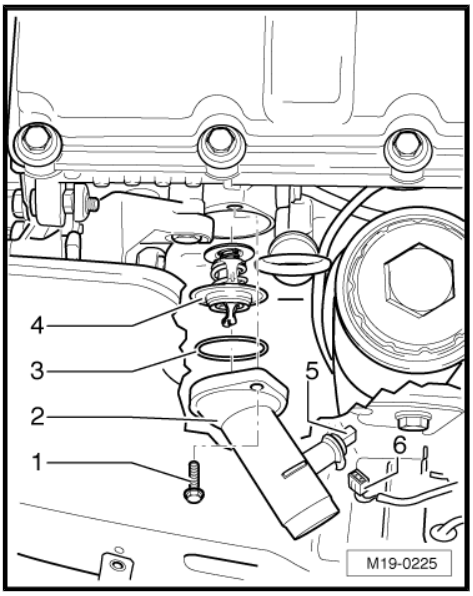
Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

Note

Always renew seals and gaskets.

– Drain off coolant ⇒ page 127 .

– Remove alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator 1.9 l TDI engine .
– Pull coolant hose off connection.
– Pull connector -6- off radiator outlet coolant temperature sender -G83- -5-.
– Remove securing bolts -1- of connection -2- and remove connection -2- with thermostat -4-.
– Turn thermostat -4- 1/4 turn (90°) to left and remove from connection -2-.



1.10.2 Installing

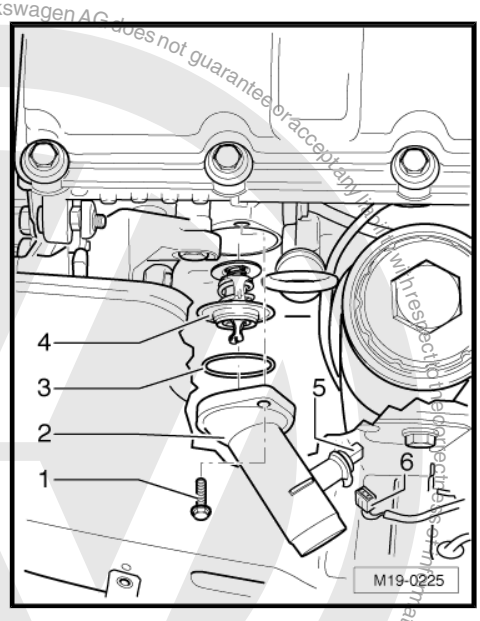
Install in reverse order. In the process, note the following:

– Moisten new O-ring -3- with coolant.
– Insert thermostat -4- into connection -2- and turn 1/4 turn (90°) to right.

Note

The brace on the thermostat must be almost vertical.

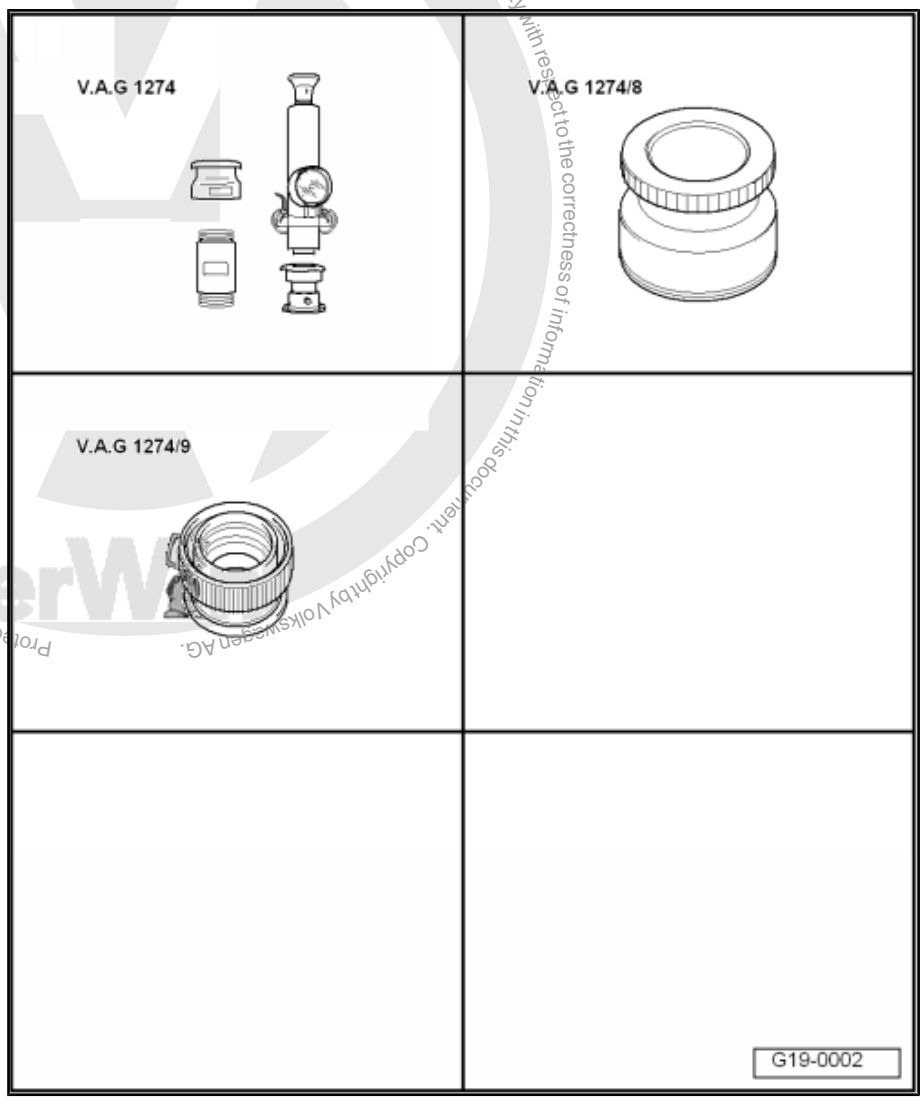
– Insert connection -2- with thermostat -4- in cylinder block.
– Tighten securing bolts -1- to 15 Nm.
– Fit connector -6- on radiator outlet coolant temperature sender -G83- -5-.
– Fill coolant system with coolant ⇒ page 127 .



1.11 Checking cooling system for leaks

Special tools and workshop equipment required

- Cooling system tester - V.A.G 1274-
- Adapter for cooling system -V.A.G 1274/8-
- Adapter for cooling system -V.A.G 1274/9-



Test prerequisites

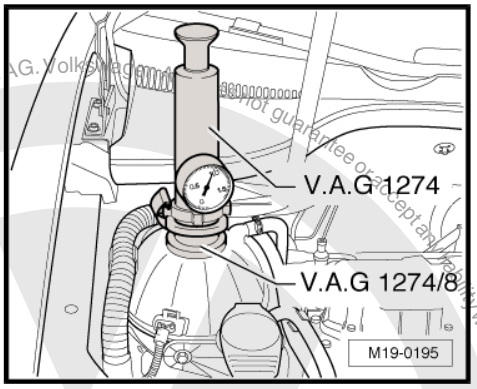
- Engine at operating temperature.

Test sequence:

> **WARNING**
>
> *Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.*

– Open cap on coolant expansion tank.

– Fit coolant system tester -V.A.G 1274- using adapter -V.A.G 1274/8- on expansion tank.
– Use hand pump on tester to create a pressure of about 1.0 bar.

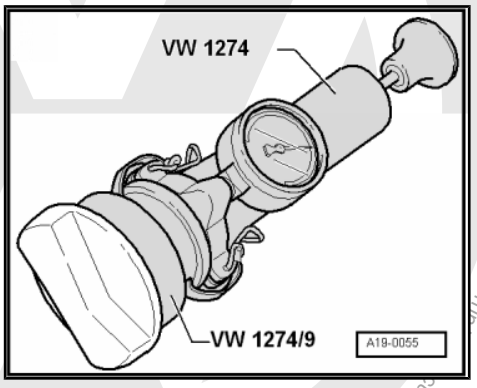


If pressure drops:

– Find leaks and rectify.

Checking pressure relief valve in filler cap

– Fit coolant system tester -V.A.G 1274- onto sealing cap using adapter -V.A.G 1274/9- .
– Use hand pump on cooling system tester -V.A.G 1274- to create a pressure of max. 1.4 bar.



The pressure relief valve must not open.

If the pressure relief valve opens prematurely:

– Renew sealing cap.
– Increase pressure by 1.4...1.6 bar.

Pressure relief valve must open.

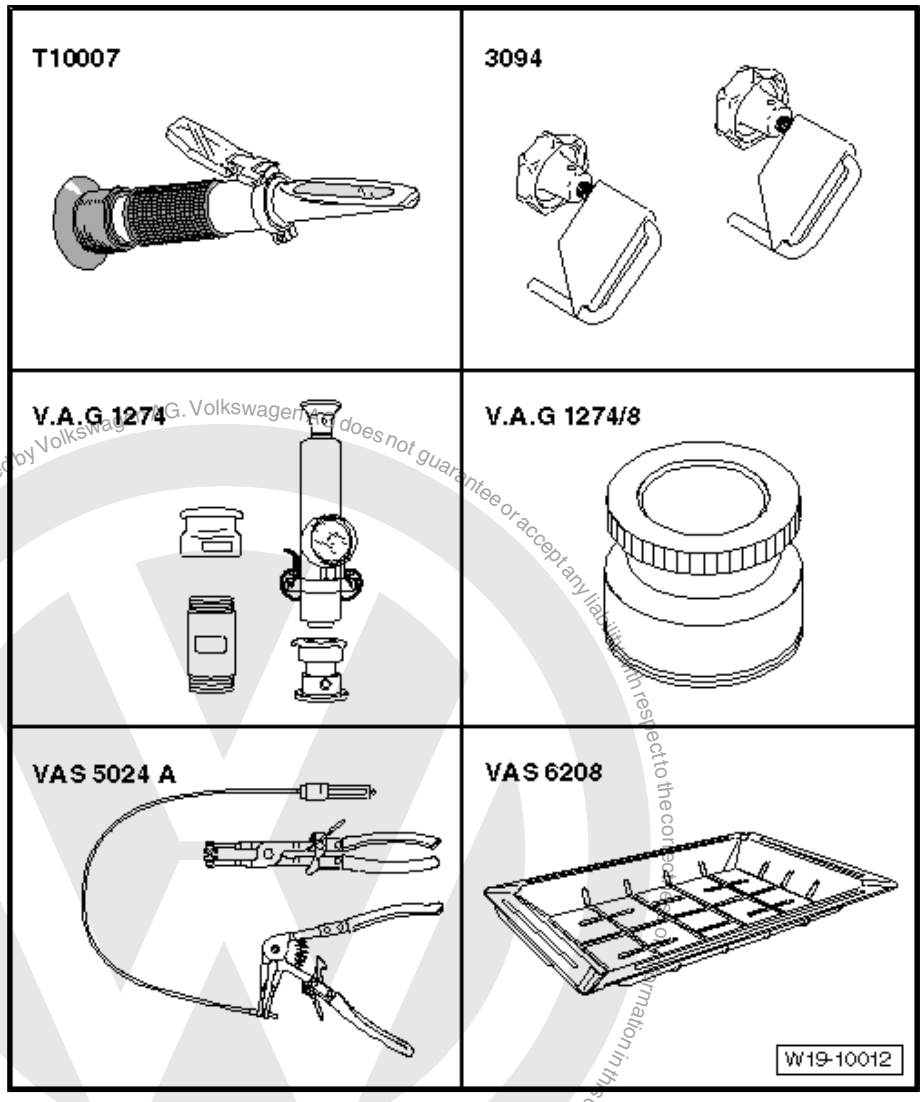
If pressure relief valve does not open:

– Renew sealing cap.

1.12 Checking oil cooler for leaks

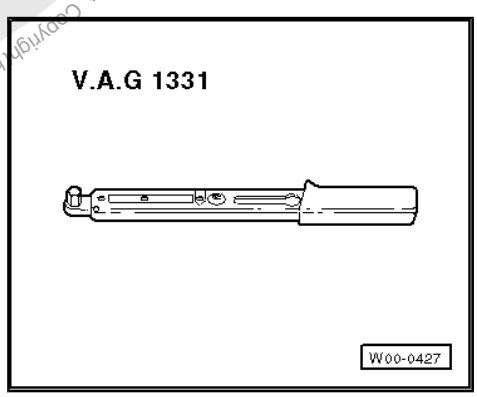
Special tools and workshop equipment required

- Refractometer -T10007-
- Hose clamps up to Ø 25 mm -3094-
- Cooling system tester -V.A.G 1274-
- Adapter for cooling system -V.A.G 1274/8-
- Spring-type clip pliers -VAS 5024A-
- Drip tray -V.A.G 1306- or drip tray for workshop hoist -VAS 6208-



Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



Not illustrated

- Expansion tank -1K0 121 407 A or 6Q0 121 407 A or 1J0 121 407 B-
- Plug -191 211 343-

- Cap -1J0 121 324-
- Coolant hose -251 265 056-

Test requirement:

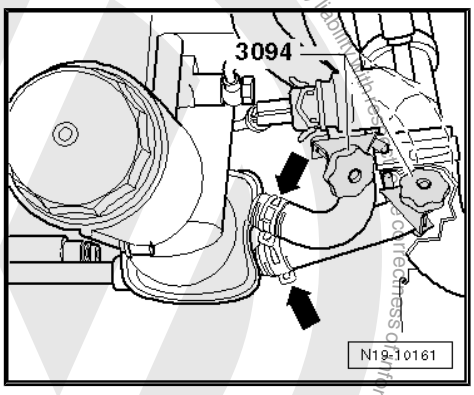
- Engine cold

Test procedure

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Clamp supply and return lines off oil cooler using hose clamps to Ø 25 mm -3094- .

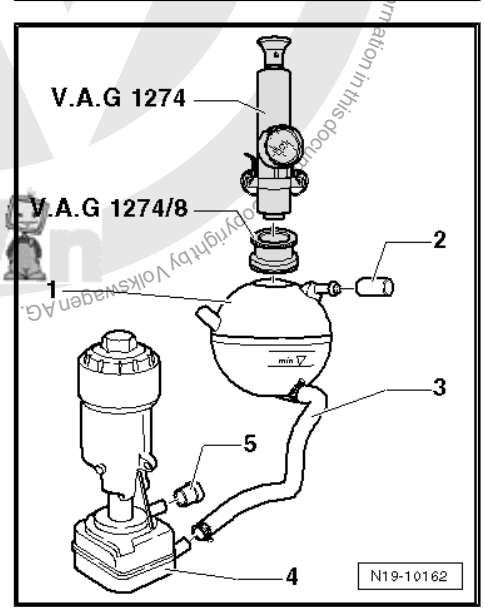
– Loosen hose clamps -arrows- using spring-type clip pliers -VAS 5024A- .



Note

Collect escaping coolant with drip tray - V.A.G 1306- or drip tray -VAS 6208- .

– Pull coolant hoses off oil cooler.



– Slide sealing cap -5- to rear connection of oil cooler -4-.

– Secure sealing plug -2- to breather connection of expansion tank -1-.

– Secure coolant hose -3- to oil cooler and expansion tank.

– Fill expansion tank up to “Max” marking.

– Attach cooling system tester -V.A.G 1274- with cooling system tester adapter -V.A.G 1274/8- to expansion tank.

– Use hand pump on tester to create a pressure of about 1.6 bar.

– Watch pressure drop on pressure gauge. A pressure drop within 10 minutes is not permitted.

If pressure drops:

– Renew oil cooler ⇒ page 106 .

Carry out installation in the reverse sequence, noting the following:

– Check coolant level, if necessary replenish coolant ⇒ page 127 .

20 – Fuel supply system

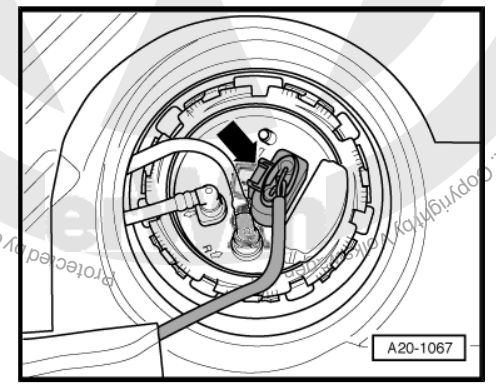
1 Safety precautions when working on fuel supply system

WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.*
- *Ensure that there is sufficient clearance to all moving or hot components.*
- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

The fuel pump is activated when switching on the ignition and by the driver's door contact switch. For safety reasons, the connector -arrow- must be removed from the fuel delivery unit before opening the fuel system, if the battery is not disconnected.



When removing and installing fuel gauge sender or fuel pump (fuel delivery unit) from a full or partly full fuel tank, observe the following:

- Before beginning work, place an extraction hose close to sender opening in fuel tank to extract escaping fuel fumes and switch on exhaust extraction system. If no exhaust extraction system is available, a radial fan with a displacement greater than 15 m^3/h can be used providing that motor is not in air flow.
- Prevent skin contact with fuel! Wear fuel-resistant gloves!

2 Rules for cleanliness

When working on the fuel supply and injection systems, pay careful attention to the following “6 rules” for cleanliness:

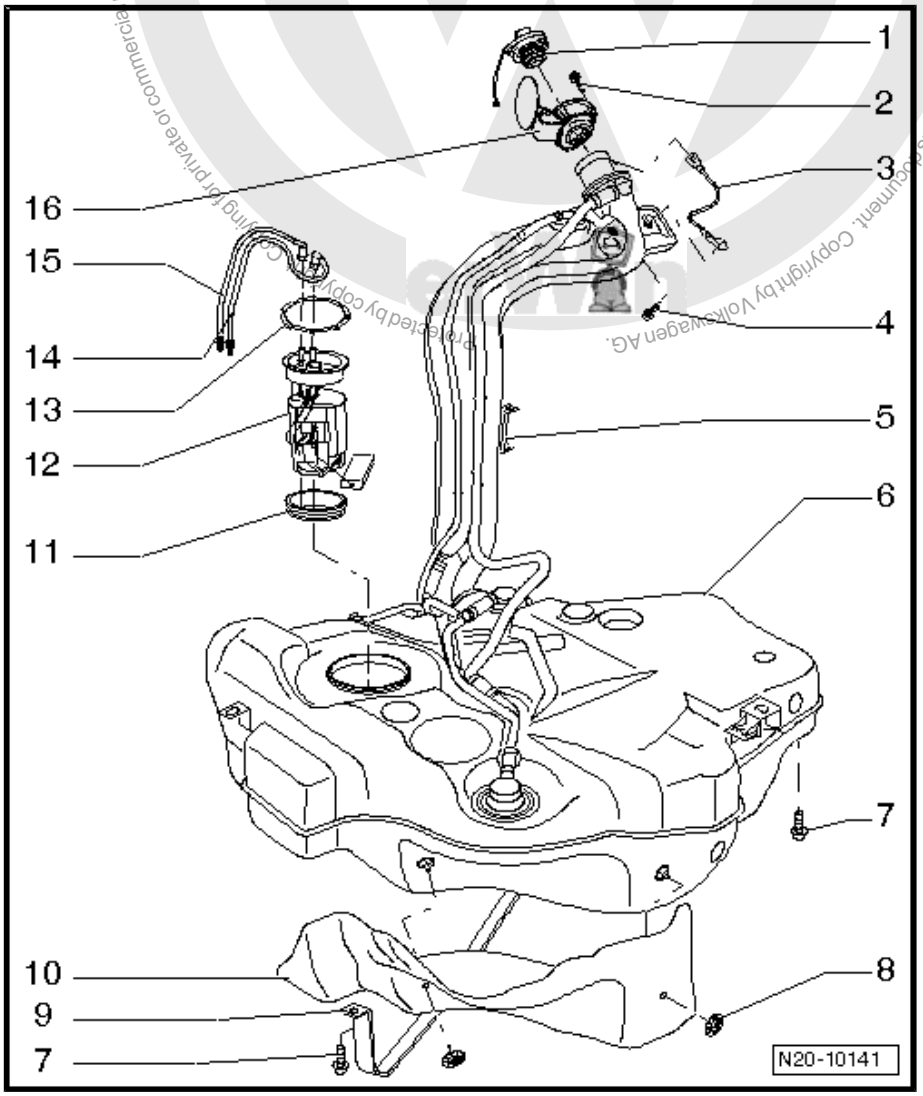
- Thoroughly clean all unions and adjacent areas before disconnecting.
- Place removed parts on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes, etc.).
- When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3 Fuel tank, models with front-wheel drive

Note

- *Hose connections are secured with either spring-type or clamp-type clips.*
- *Always renew clamp-type clips with spring-type clips.*
- *Spring-type clip pliers -VAS 5024A- or hose clip pliers -V.A.G 1921- are recommended for installation of spring-type clips.*

3.1 Assembly overview - fuel tank



1 - Cap

2 - 1.5 Nm

3 - Earth connection
- ❑ Check for secure seating.

4 - 10 Nm

5 - Cable guide

6 - Fuel tank
- ❑ Removing and installing ⇒ page 149 .

7 - 25 Nm
- ❑ Renew.

8 - Clamping washer

9 - Securing strap
- ❑ Note installation position.

10 - Heat shield
- ❑ For fuel tank.

11 - Oil seal
- ❑ Renew.
- ❑ Moisten with fuel when installing.

12 - Fuel delivery unit
- ❑ With fuel gauge sender -G -
- ❑ Note installation position in fuel tank ⇒ page 146
- ❑ Removing and installing ⇒ page 152 .
- ❑ Checking fuel pump ⇒ page 154 .
- ❑ Removing and installing fuel gauge sender -G- ⇒ page 154 .
- ❑ Clean strainer if soiled

13 - Locking ring, 110 Nm
- ❑ Remove and install using fuel tank sender wrench -T10202-

14 - Supply line
- ❑ To fuel filter ⇒ Item 1 (page 158) .

- ❑ Clipped onto fuel tank.
- ❑ Check for secure seating.
- ❑ Black.
- ❑ To pull off, press release buttons on connecting piece

15 - Return line

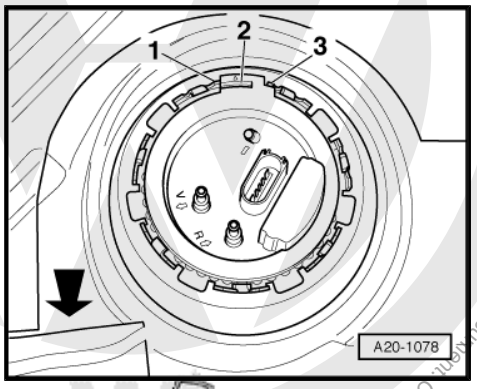
- ❑ From fuel cooler
- ❑ Blue or with blue marking
- ❑ Clipped onto fuel tank.
- ❑ Check for secure seating.
- ❑ To pull off, press release buttons on connecting piece

16 - Tank flap unit

- ❑ Removing and installing ⇒ General body repairs, exterior; Rep. Gr. 55 ; Tank flap unit .

Installation position of fuel delivery unit:

The tab -2- on the fuel delivery unit must lie between the tongues -1- and -3-.



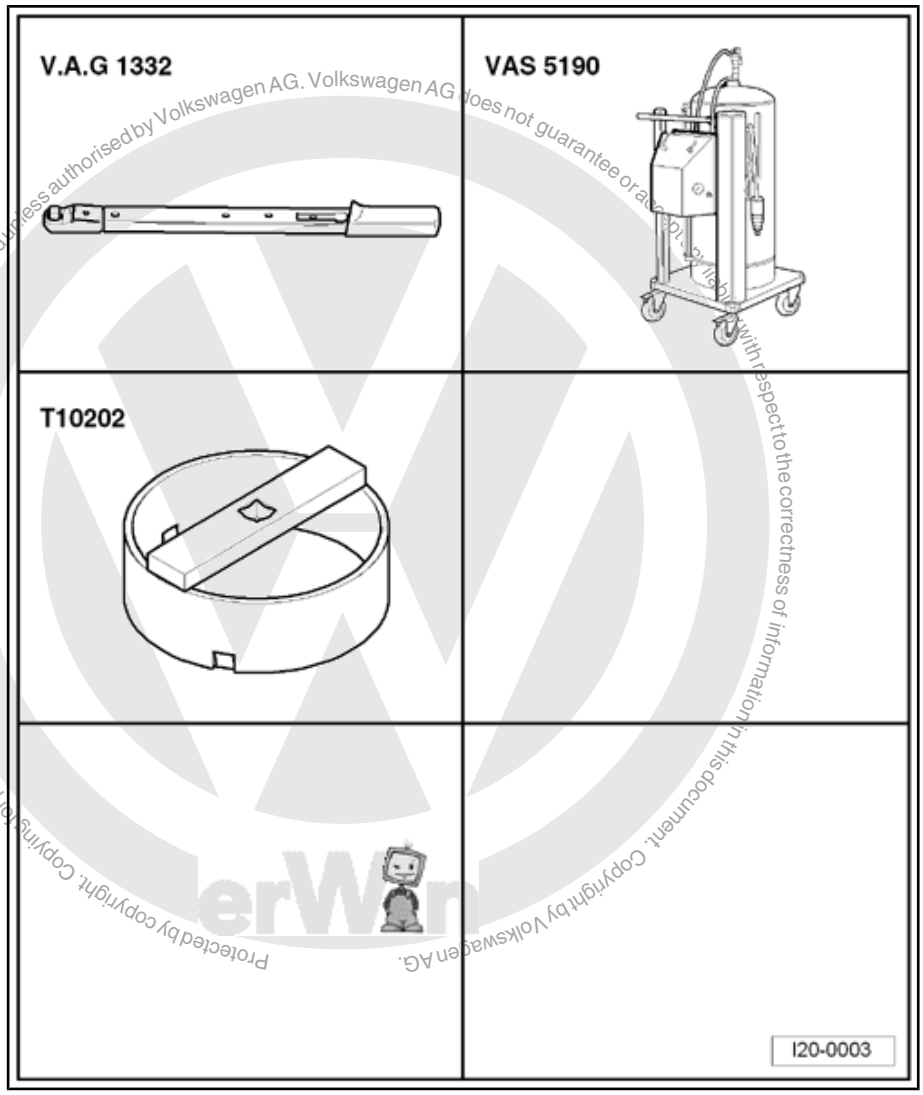
Note

- ♦ *The -arrow- points in direction of travel.*
- ♦ *The fuel delivery unit can only be installed in this position.*

3.2 Draining fuel tank

Special tools and workshop equipment required

- Torque wrench -V.A.G 1332-
- Fuel extractor unit -VAS 5190-
- Insert -T10202-



– Note safety precautions before beginning work ⇒ page 142
– Observe rules for cleanliness ⇒ page 143

Emptying fuel tank if it is more than $^3/_4$ full ⇒ page 147

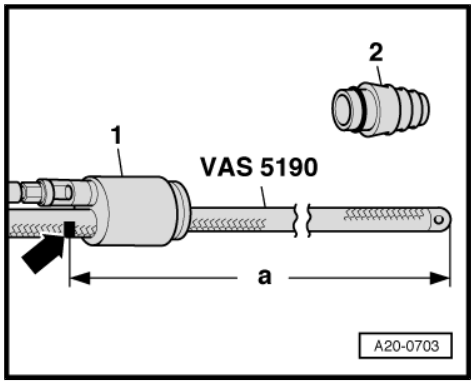
Empty fuel tank if it is less than $^3/_4$ full ⇒ page 148

3.2.1 Emptying fuel tank if it is more than $^3/_4$ full

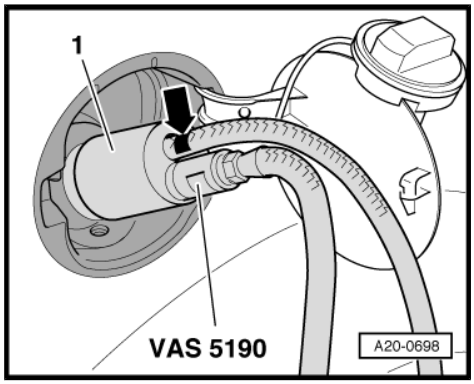
Caution

Secure earth wire of fuel extractor -VAS 5190- to a bare metal part of the body.

– Remove cotter -2- from shaft piece -1- of fuel extractor - VAS 5190 - .
– Use insulating tape to mark the extraction hose -arrow- at a distance of -a- = 1,180 mm from the end of the hose.



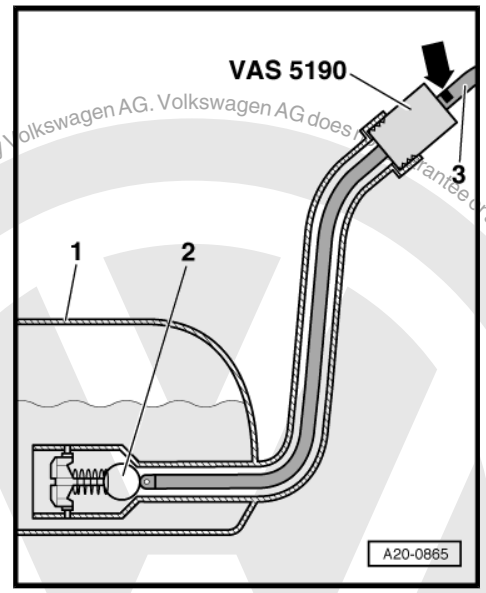
– Remove filler cap from fuel tank filler neck.
– Screw shaft -1- of fuel extractor -VAS 5190- onto fuel tank filler neck.
– Push extraction hose into fuel tank until marking on hose -arrow- coincides with shaft end.



Note

A ball valve -2- is located at the lower end of filler neck in fuel tank -1-, which must not be damaged by the extraction hose -3-. Therefore push hose into filler neck only as far as marking -arrow-.

– Empty fuel tank as far as possible.
– Carefully pull out extraction hose.



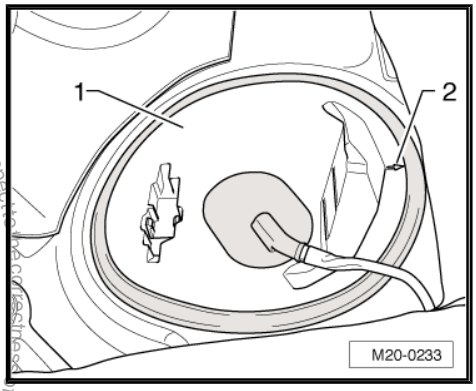
Note

- *If no fuel is be sucked any more, the fuel tank is just sufficiently vacant to open the fuel delivery unit without danger.*
- *If you have to empty the fuel tank completely* *⇒ page 148* .

3.2.2 Emptying fuel tank if it is less than 3/4 full

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seat; Removing and installing seat bench .

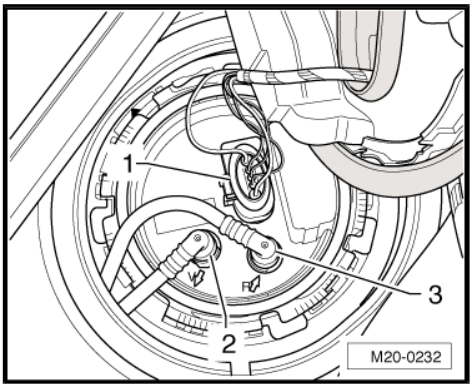
– Remove cover -1- from fuel delivery unit. The arrow -2- points in direction of travel.



WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Remove connector -1-, the supply line -2- and the return pipe -3- from the fuel delivery unit. Press locking ring inwards to release fuel lines.

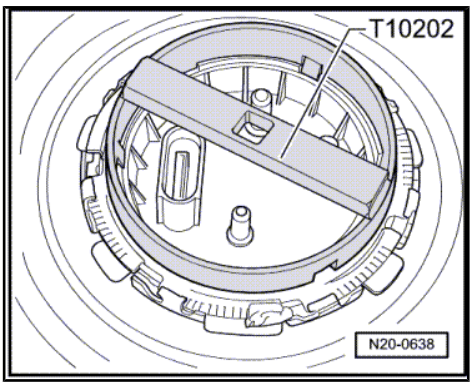


– Open locking ring using fuel tank sender tool -T10202- .

– Pull out the fuel delivery unit a bit.

– Insert extraction hose of fuel extractor -VAS 5190- as deeply as possible into fuel tank and extract fuel.

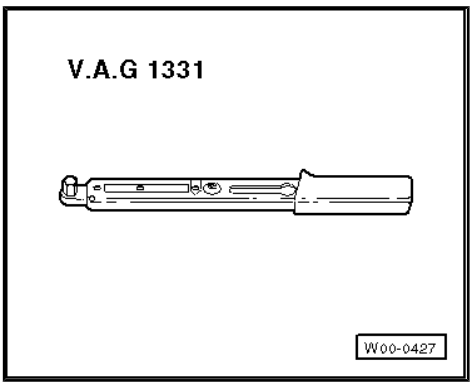
If the fuel tank must only be emptied, install fuel delivery unit again.



3.3 Removing and installing fuel tank

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



Removing

- Fuel tank should be no more than 1/4 full.

Note

- *If necessary, empty fuel tank using fuel extractor -VAS 5190- ⇒ page 147 .*
- *Note safety precautions before beginning work ⇒ page 142 .*
- *Observe rules for cleanliness ⇒ page 143 .*
- *Before carrying out further work, disconnect battery earth strap. First check whether a coded radio is fitted. Obtain anti-theft code first if necessary.*
- *The fuel tank must be guided carefully when lowering to prevent damage.*

– If necessary, take the adapter for the rim lock out of the luggage compartment.

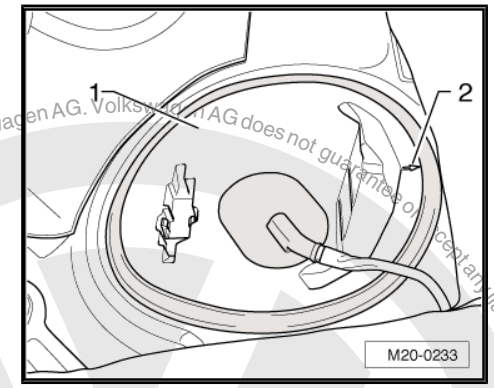
– Open fuel flap and remove fuel tank cap.

– With ignition switched off, disconnect battery earth wire ⇒ Electrical system; Rep. Gr. 27 ; Disconnecting and connecting battery .

– Unscrew tank flap unit securing bolt and remove tank flap unit ⇒ General body repairs, exterior; Rep. Gr. 55 ; Tank flap unit .

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seat; Removing and installing seat bench .

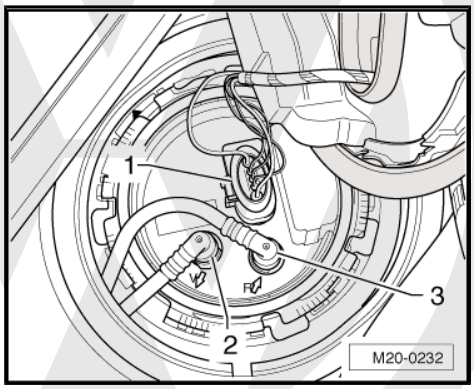
– Remove cover -1- from fuel delivery unit. The arrow -2- points in direction of travel.



– Pull off connector -1-.

– Remove right rear wheel.

– Remove rear right wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Wheel housing liner; Removing and installing rear wheel housing liner .

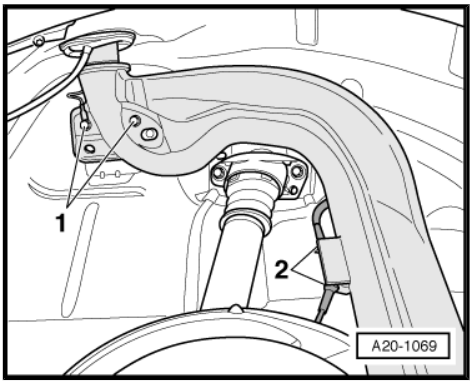


– Unscrew bolts -1- for fuel filler neck.

– Unhook electrical wiring -2- of ABS speed sensor on filler neck bracket.

– Remove front silencer, separate front and rear silencer first, if necessary ⇒ page 259 .

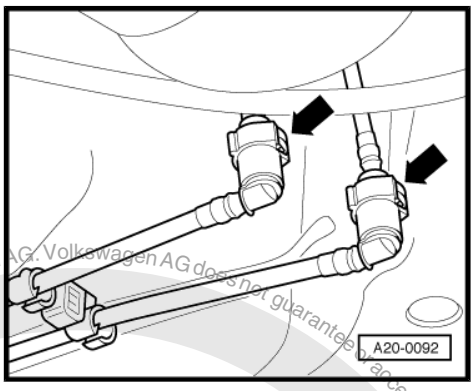
– Remove heat shield from fuel tank.



WARNING

- ***The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!***
- ***The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!***
- ***Wear eye and hand protection when performing any type of repair work on the fuel system!***

– Separate the black supply line and the blue return hose -arrows- on front right of fuel tank.



Note

To do this, press buttons on hose couplings downwards.

– In vehicles with additional heater, disconnect connector of the metering pump and unclip cable ⇒ Additional heater; Rep. Gr. 82 ; Fuel supply system of additional heaters Thermo Top V; Removing and installing metering pump -V54- .

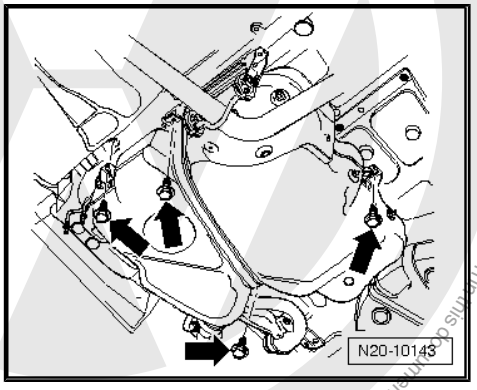
Note

- *Press locking ring inwards to release fuel lines.*
- *A second mechanic is required to assist when supporting the fuel tank.*

– Remove tensioning strap and securing bolts -arrows-.

– Slowly lower fuel tank.

– Remove fuel tank from side.



Installing

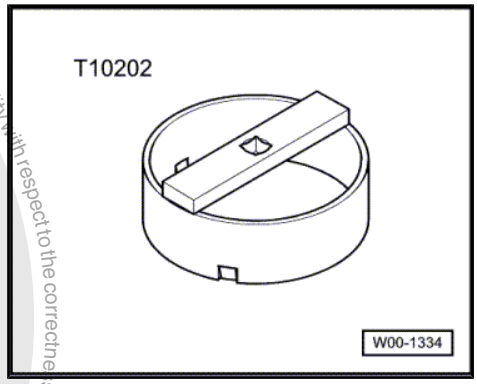
Installation is performed in the reverse sequence. In the process, note the following:

- Fuel lines are to be installed free of kinks.
- Do not interchange supply and return lines (return line blue, supply line black).
- Ensure that fuel line connections are tight.
- Check earth connection on fuel tank and body to filler neck.
- After installing fuel tank, check that the supply and return lines are still clipped onto the fuel tank.

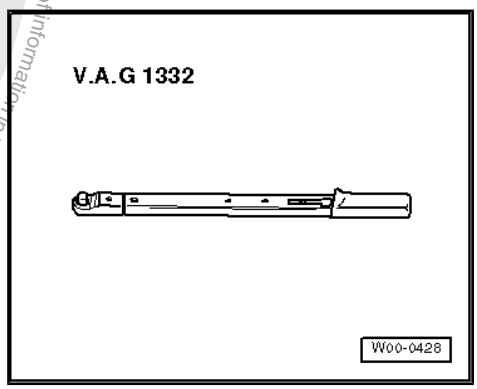
3.4 Removing and installing fuel delivery unit

Special tools and workshop equipment required

- Fuel tank sender unit tool -T10202-



- Torque wrench -V.A.G 1332-



Removing ⇒ page 152

Installing ⇒ page 153

3.4.1 Removing

- Fuel tank should be no more than $^{3}/_{4}$ full.

Note

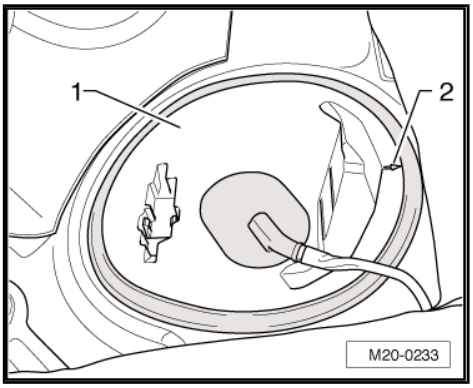
- *If necessary, empty fuel tank using fuel extractor -VAS 5190- ⇒ page 147 .*
- *Note safety precautions before beginning work ⇒ page 142 .*
- *Observe rules for cleanliness ⇒ page 143 .*

– First check whether a coded radio is fitted. If so, obtain anti-theft coding.

– With ignition switched off, disconnect battery earth wire ⇒ Electrical system; Rep. Gr. 27 ; Disconnecting and connecting battery .

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seat; Removing and installing seat bench .

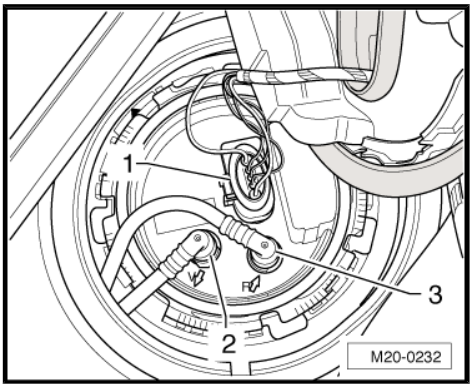
– Remove cover -1- from fuel delivery unit. The arrow -2- points in direction of travel.



WARNING

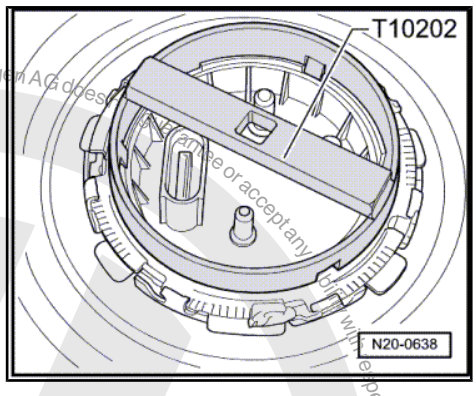
- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Remove the connector -1-, the black supply line -2- and the blue return pipe -3- from the fuel delivery unit. Press locking ring inwards to release fuel lines.



– Open locking ring using wrench -T10202- .

– Pull fuel delivery unit and seal out of opening in fuel tank.

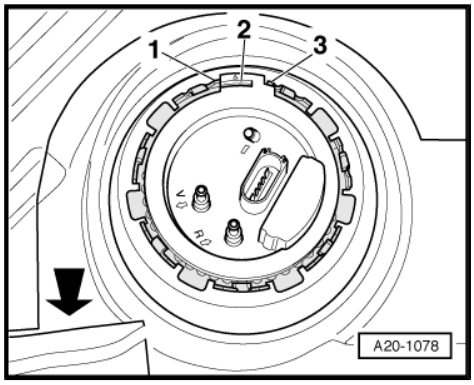


Note

- *When removing fuel delivery unit, ensure that fuel gauge sender is not bent.*
- *If the fuel delivery unit is to be renewed, drain old fuel delivery unit before disposal.*

3.4.2 Installing

Installation of fuel delivery unit is carried out in reverse order. In the process, note the following:

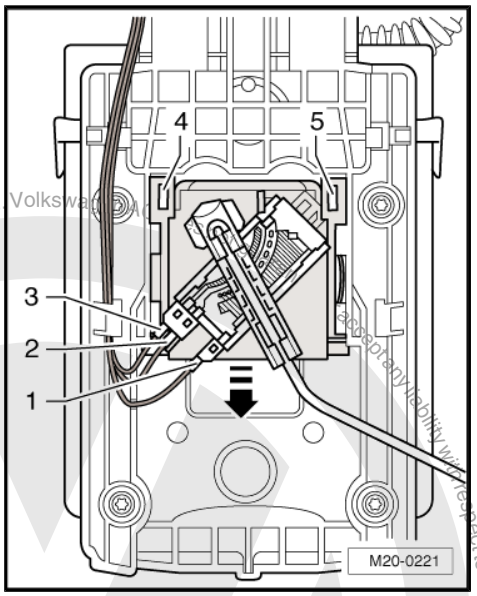


- Insert new fuel delivery unit seal dry into fuel tank opening.
- Moisten inner edges of seal with fuel only when installing fuel delivery unit.
- When inserting fuel delivery unit, ensure that fuel gauge sender is not bent.
- Check installation position of the fuel delivery unit: Tab -2- on the fuel delivery unit must be between cogs -1- and -3-. The -arrow- points in direction of travel.
- Tighten lock ring to 110 Nm.
- Do not interchange the black supply line and the blue return line (arrows on the flange of the fuel delivery unit).
- Ensure that fuel lines are tight.
- After installing the fuel delivery unit, check that the supply and return lines are still clipped onto the fuel tank.
- Follow procedure after reconnecting battery ⇒ Electrical system; Rep. Gr. 27 ; Disconnecting and reconnecting battery .

3.5 Removing and installing fuel gauge sender

Removing

– Remove fuel delivery unit ⇒ page 152 .
– Release and remove line connectors -1…3-.
– Lift up retaining lugs -4- and -5- using a screwdriver and pull fuel delivery unit off downwards -arrows-.



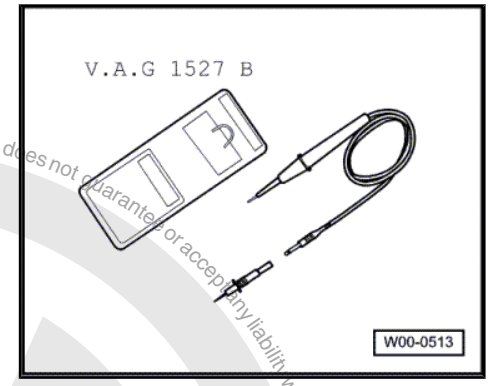
Installing

– Insert fuel gauge sender -G- into guides on fuel delivery unit and press upwards until it engages.
– Reconnect connector and check that it has engaged correctly.

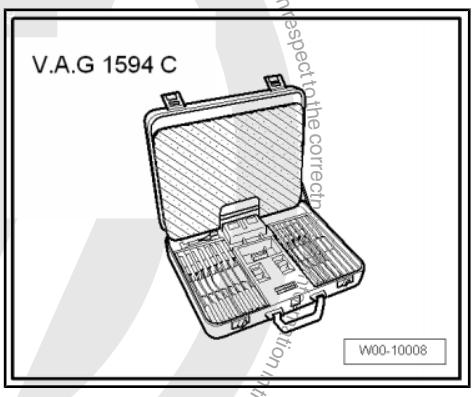
3.6 Checking fuel pump

Special tools and workshop equipment required

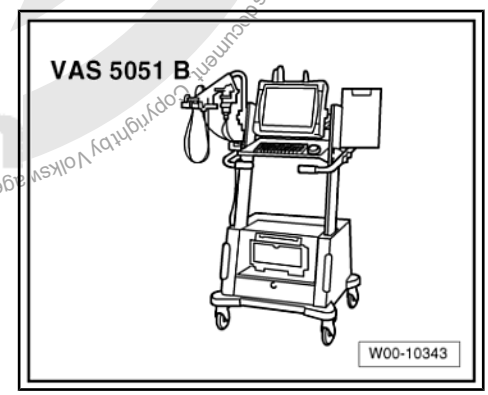
- Voltage tester -V.A.G 1527 B-



- Auxiliary measuring set -V.A.G 1594C-



- Vehicle diagnosis, testing and information system -VAS 5051B-



Test prerequisites

- Fuses must be OK.
- The battery voltage must be at least 11.5 V.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.

Checking function and voltage supply ⇒ page 155

Check the current draw of the fuel pump ⇒ page 156

3.6.1 Checking function and voltage supply

– Switch on ignition.

- Fuel pump must be heard to run briefly.

Note

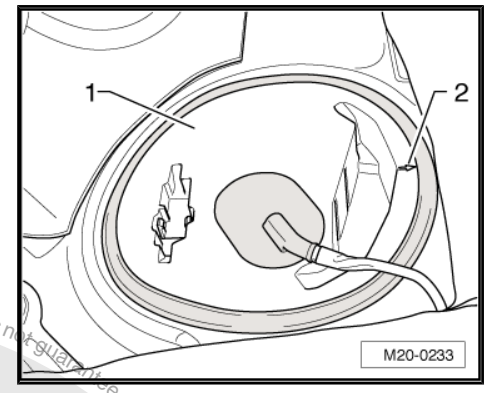
The fuel pump runs very quietly.

– Switch off ignition.

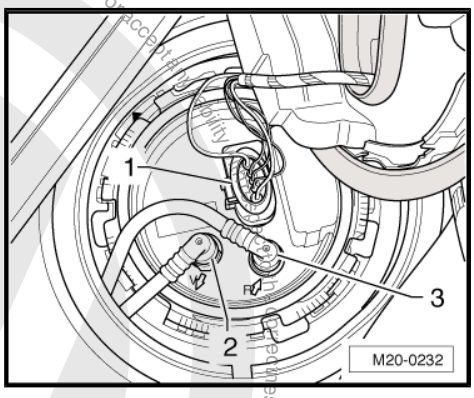
If fuel pump does not run:

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seat; Removing and installing seat bench .

– Remove cover -1- from fuel delivery unit. The arrow -2- points in direction of travel.



– Pull off connector -1-.



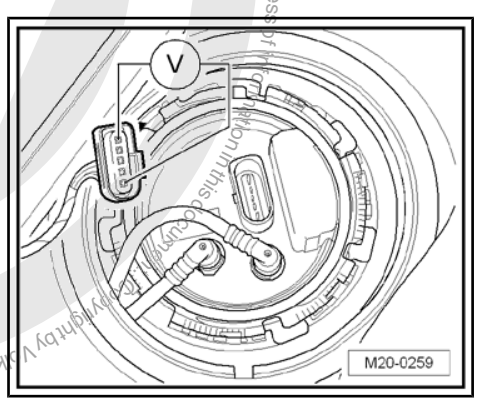
– Connect voltage tester -V.A.G 1527 B- to outer contacts of connector using auxiliary cables from auxiliary measuring set -V.A.G 1594C-

– Switch ignition on.

• The LED must light up briefly.

LED does not light up briefly:

– Locate and eliminate open circuit using current flow diagram ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



LED lights up briefly (voltage supply OK?):

– Remove fuel delivery unit ⇒ page 152 .

– Check that the electrical wires between flange and fuel pump are connected and for continuity.

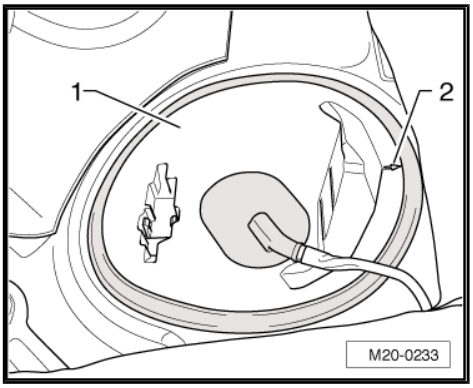
If no open circuit can be found

– Renew fuel delivery unit ⇒ page 152 .

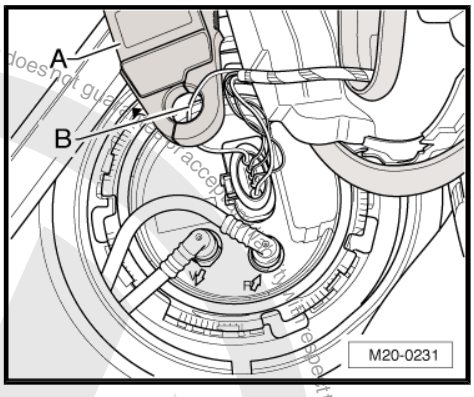
3.6.2 Checking current consumption of fuel pump

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seat; Removing and installing seat bench .

– Remove cover -1- from fuel delivery unit. The arrow -2- points in direction of travel.

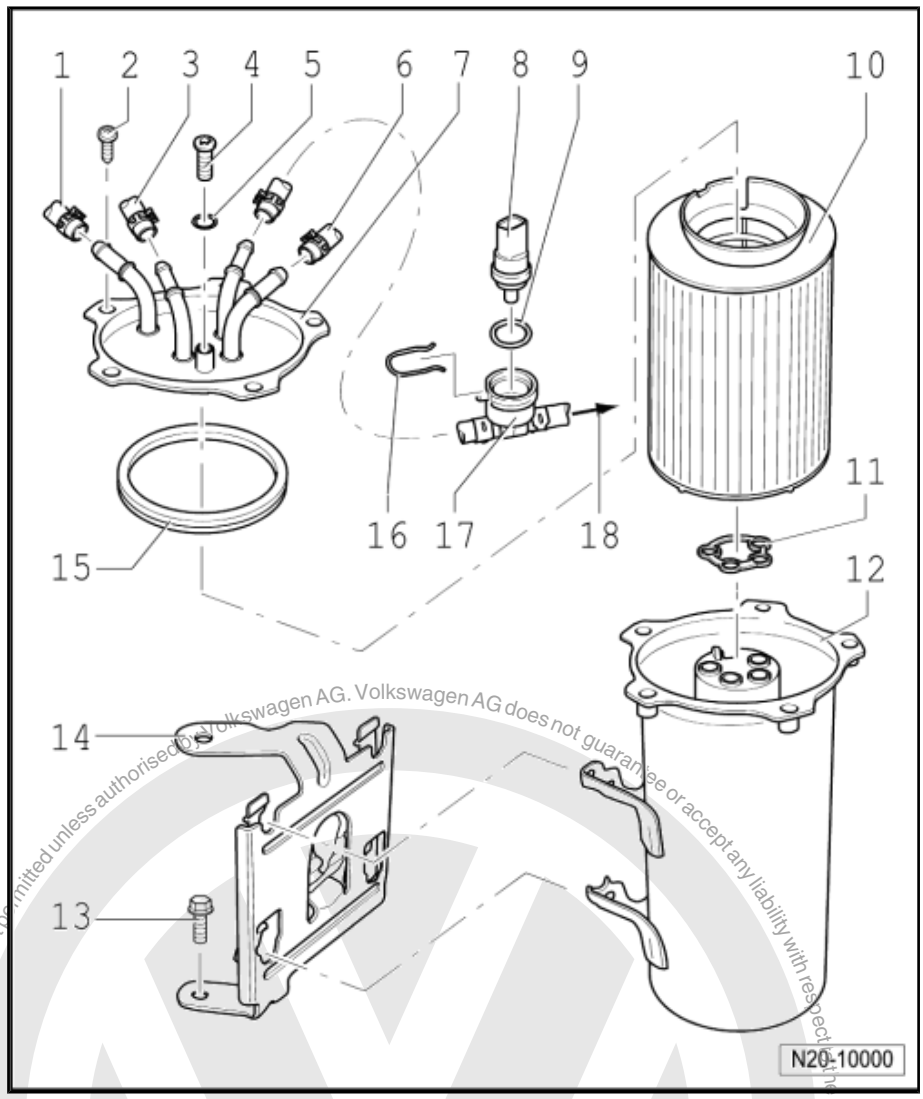


– Connect the current clamp -A- of the Vehicle diagnosis, testing and information system -VAS 5051B - to the cable -B- to contact 1 of the 5-pin connector.
– Start engine and run at idling speed.
– Measure current draw of fuel pump. Specification: max. 7.5 Ampere.
– If the values measured lie outside the specifications
– Renew fuel delivery unit ⇒ page 152 .



4 Repairing fuel supply system

4.1 Assembly overview - fuel filter



1 - Supply line

- ❑ From fuel tank ⇒ Item 14 (page 145) .
- ❑ White or with white marking.
- ❑ Check for secure seating.

2 - 8 Nm

3 - Return line

- ❑ To fuel cooler
- ❑ Check for secure seating.
- ❑ Blue or with blue marking

4 - Sealing plug for water evacuation, 4 Nm

- ❑ Remove and evacuate approx. 100 cm^3 liquid using diesel extractor -VAS 5226- or hand-operated vacuum pump with accessories -V.A.G 1390- and water drainage container -V.A.G 1390/1-

5 - Oil seal

- ❑ Renew.

6 - Return line

- ❑ From tandem pump.
- ❑ Blue marking
- ❑ Check for secure seating.

7 - Upper part of fuel filter

8 - Fuel temperature sender -G81-

9 - Oil seal

- ❑ Renew.

10 - Filter insert

- ❑ Observe change intervals.

11 - Oil seal

- ❑ Renew.

12 - Lower part of fuel filter

13 - 8 Nm

14 - Retainer

15 - Oil seal

- ❑ Renew.

16 - Securing clip

- ❑ Check for secure seating.

17 - Supply line

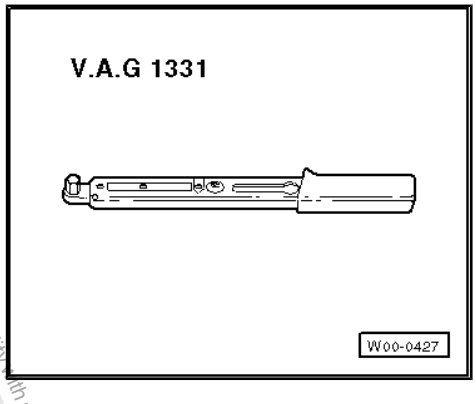
- ❑ With pipe union for fuel temperature sender -G81-

18 - To tandem pump

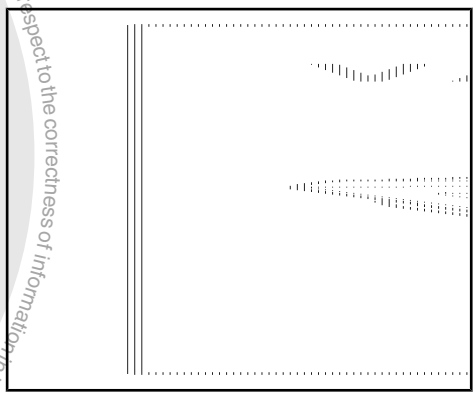
4.2 Removing and installing fuel cooler

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331-



- ♦ Drip tray for workshop hoist -VAS 6208 -



Removing ⇒ page 159

Installing ⇒ page 160

4.2.1 Removing

– Note safety precautions before beginning work ⇒ page 142 .

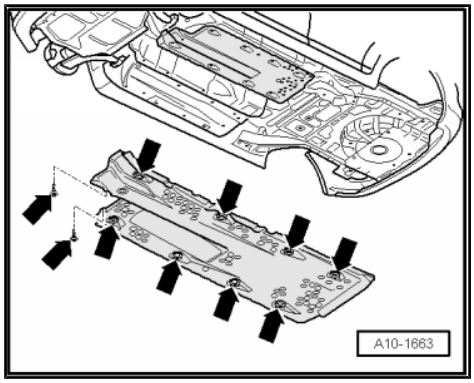
– Observe rules for cleanliness ⇒ page 143 .

Note

The fuel cooler is located in the return line to fuel tank. It is located on the vehicle underbody.

– Remove right underbody panel -arrows-.

– Place drip tray for workshop crane under the vehicle.

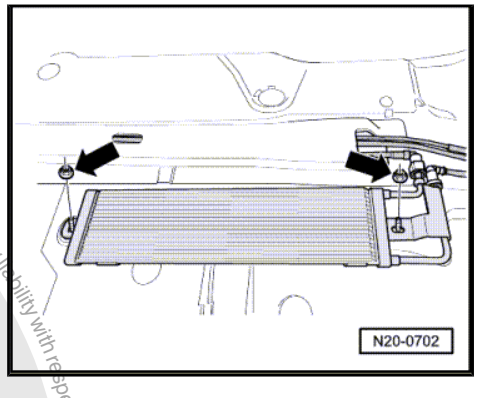


WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Then release pressure by carefully loosening the connection.*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Separate fuel lines at fuel cooler.

– Unscrew securing nuts -arrows-.



4.2.2 Installing

Install in reverse order. In the process, note the following:

- Tighten fuel cooler securing nuts to 15 Nm.

4.3 Checking tandem pump

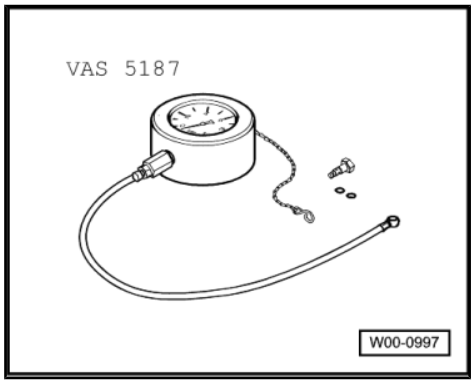
Checking delivery pressure ⇒ page 160

Checking for internal leaks ⇒ page 163

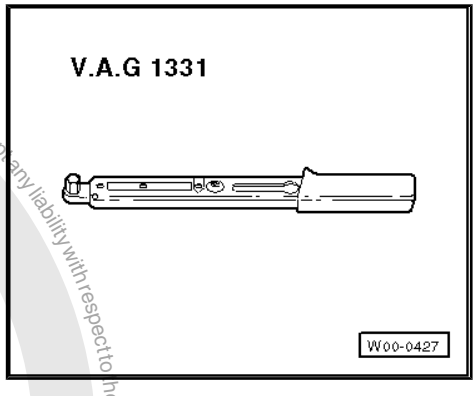
4.3.1 Checking delivery pressure

Special tools and workshop equipment required

- Tandem pump tester -VAS 5187 -



♦ Torque wrench (5..0.50 Nm) -V.A.G 1331 -



♦ Vehicle diagnosis, testing and information system -VAS 5051B-

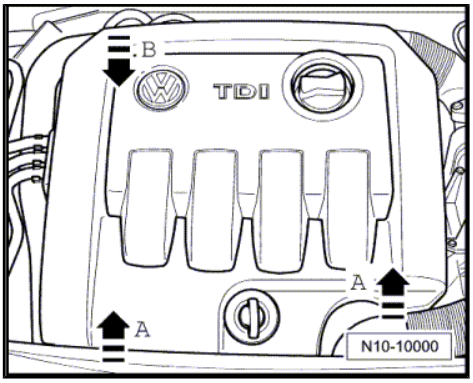
♦ Diagnosis cable -VAS 5051/6A-

Test prerequisites

- Coolant temperature must be at least 85°C.
- Unit injectors OK
- Fuel filter and fuel lines must not be blocked.
- The non-return valve in the fuel supply hose must be OK.

Procedure

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



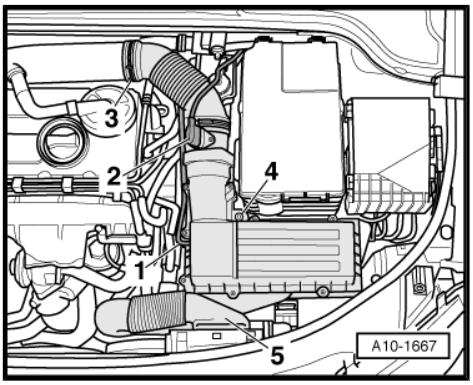
Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- and air duct hoses -3- and -5- off.

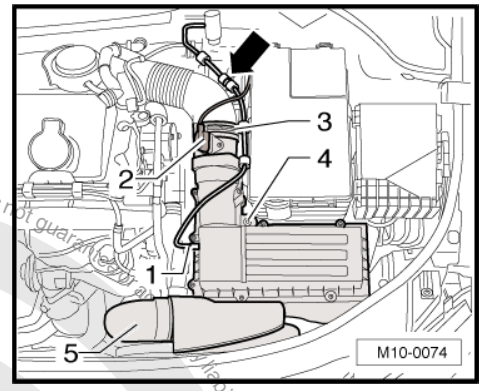
– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.

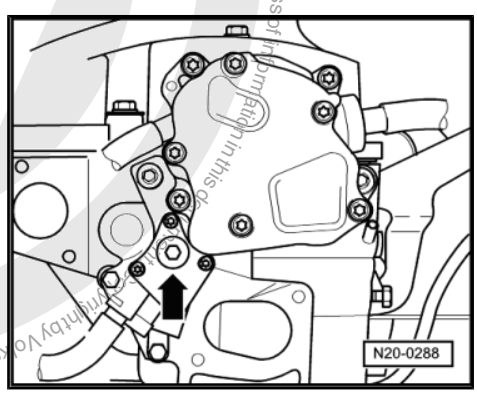


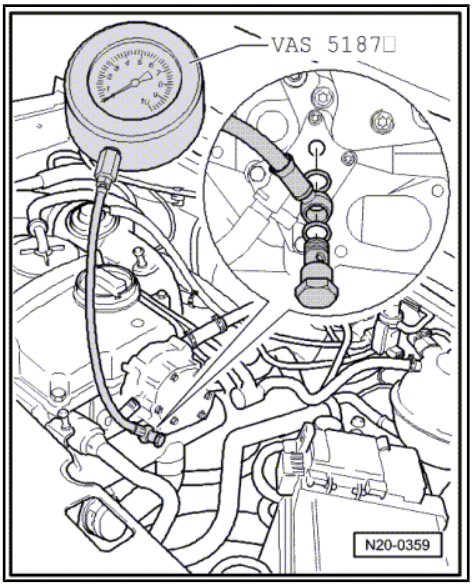
Continuation for all models

WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Remove screw plug -arrow-.





– Connect tandem pump tester -VAS 5187- as shown.
– Install air cleaner housing with air mass meter and connecting pipe.
– Start engine and run at idling speed.
– Connect Vehicle diagnosis, testing and information system - VAS 5051B- and select operating mode “Vehicle self-diagnosis”.
– Press button “01 - Engine electronics” on display.
– Press diagnosis function “08-Read measured value block”.
– Enter display group “1” using number block (key pad) and confirm entry with Q button.
– Read engine idling speed in display zone “1”.
– Increase engine speed to 4000 rpm.
– Observe pressure indicated on pressure gauge.

Specification: min. 7.5 bar

If the specification is not attained:

– Using a hose clamp, clamp-off return line between fuel filter and tandem pump.
– Increase engine speed to 4000 rpm.
– Observe pressure indicated on pressure gauge.

Specification: min. 7.5 bar

If specification is now obtained:

Pressure loss at unit injectors.

– Renew O-rings on unit injectors ⇒ page 219 .

If the specification is not attained:

– Renew tandem pump ⇒ page 166 .

Note

After removing pressure gauge, tighten plug to 25 Nm. Always renew seal.

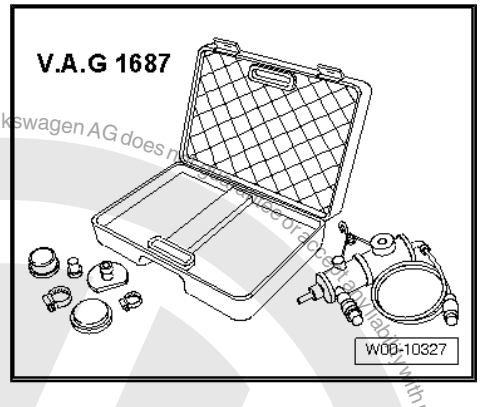
4.3.2 Checking for internal leaks

Note

The tandem pump must be checked for internal leaks between fuel side and oil side after reinstalling a used tandem pump, for example after renewing or repairing a cylinder head and/or when installing a "short" engine. When leaking it is possible for the fuel to mix with the oil, which may cause the engine to fail.

Special tools and workshop equipment required

- Charge air system tester -V.A.G 1687-



Procedure

WARNING

- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

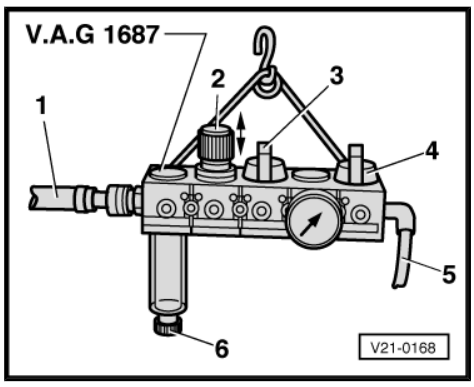
– Pull fuel supply hose (white marking) ⇒ Item 26 (page 59) and fuel return hose (blue marking) ⇒ Item 27 (page 59) off tandem pump.

– Seal fuel return union on tandem pump with a plug. Secure sealing plug with a spring-type clip.

Prepare this as follows:

– Unscrew pressure regulating valve -2- and close valves -3- and -4-.

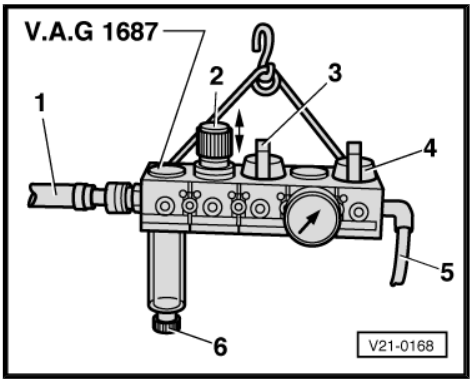
– Connect test connection -5- charge air system tester -V.A.G 1687- to fuel supply union of tandem pump using a commercially available compressed air connection and a section of fuel hose. Use a spring-type clip to secure.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

– Connect compressed air hose -1- (compressed air source) to charge air system tester -V.A.G 1687 - .



Note

If there is water in the sight glass, drain at water drain screw -6-.

– Open valve -3-.

– Adjust pressure to 1.0 bar with pressure regulating valve -2-.

Caution

The maximum test pressure is 1.3 bar and this must not be exceeded.

– Open valve -4- and wait until the test circuit is filled. If necessary readjust pressure to 1.0 bar.

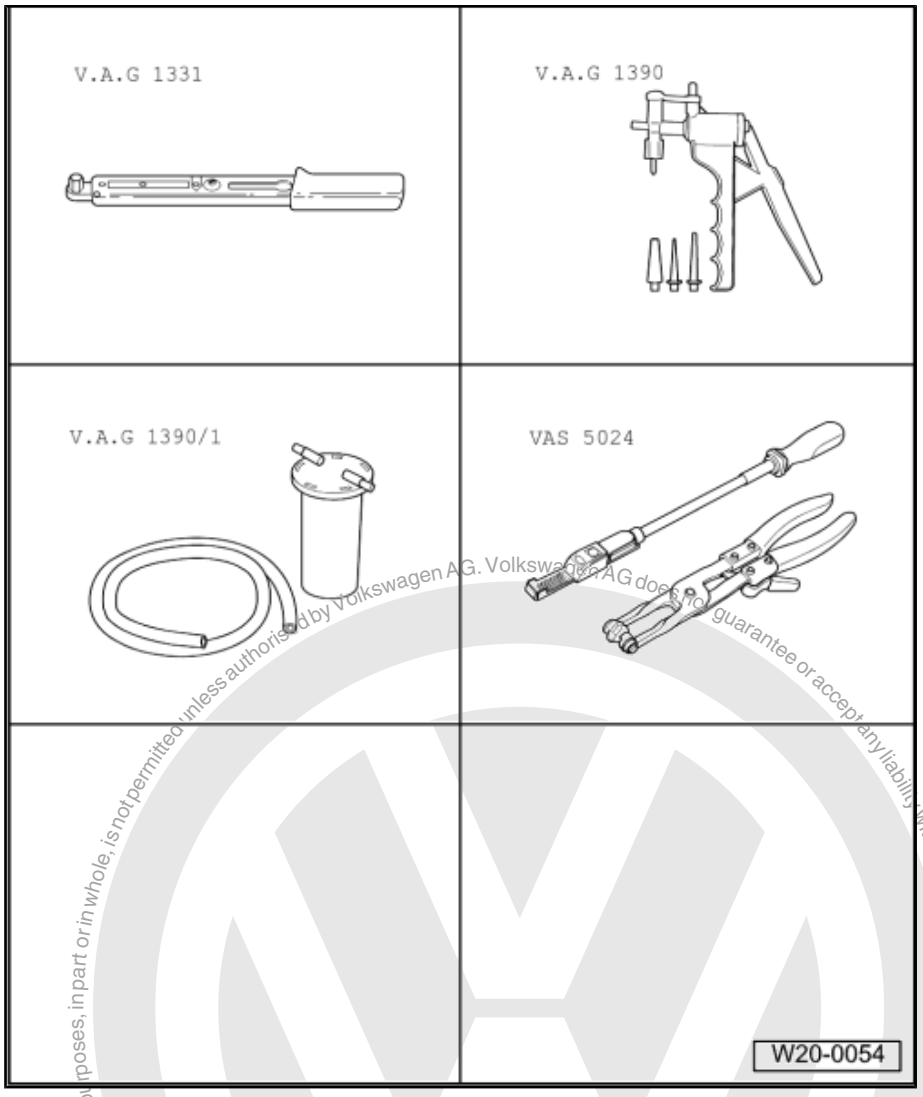
– Close valve -3- to retain pressure and observe the pressure drop over a period of 1 minute.

If the pressure does not drop the tandem pump can be reused, if the pressure drops the tandem pump must be renewed.

4.4 Removing and installing tandem pump

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Diesel extractor -VAS 5226- or
- Hand-operated vacuum pump with accessories -V.A.G 1390- and
- Water drainage container -V.A.G 1390/1-
- Spring-type clip pliers -VAS 5024A-

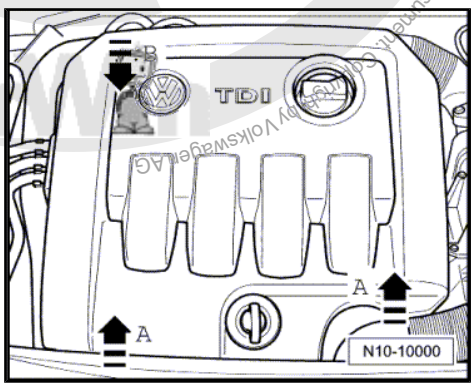


Removing ⇒ page 166

Installing ⇒ page 168

4.4.1 Removing

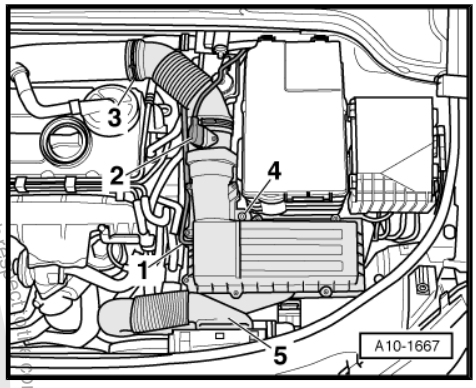
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.

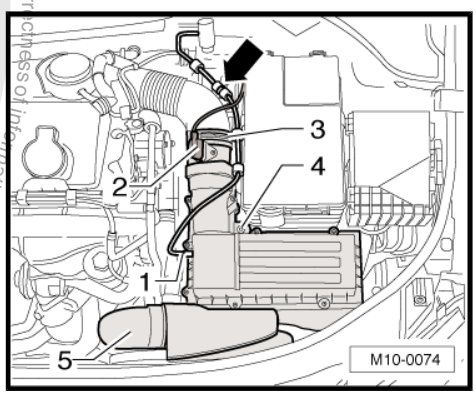
– Disconnect connector -2- on air mass meter -G70-.
– Pull breather hose -1- and air duct hoses -3- and -5- off.
– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

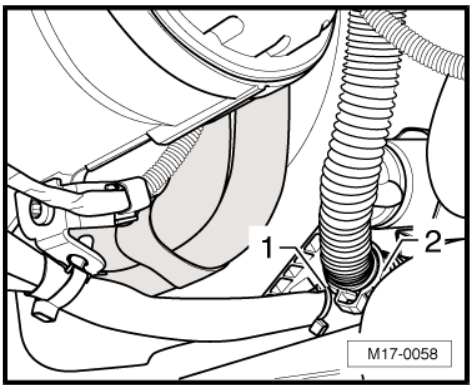
– Remove air cleaner housing with air mass meter.

– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.

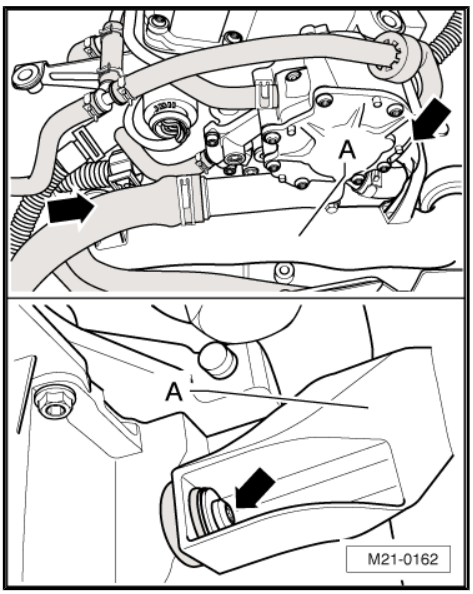


Continuation for all models

– Carefully cut through cable tie -1-.
– Open wiring retainer -2- and unhook wiring harness.



– Remove both bolts -arrows- from upper charge air pipe -A-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Remove the bolt -arrows- of the charge air pipe -A- from the oil sump.

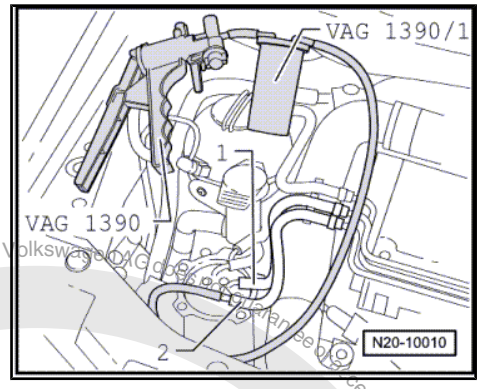


WARNING

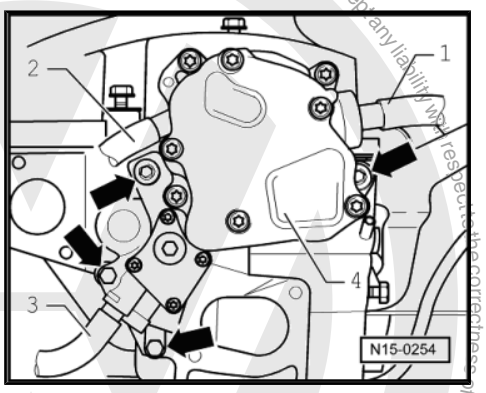
- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

– Pull supply hose (white marking) and return hose (blue marking) off fuel lines.

– Connect diesel extractor -VAS 5226 - or hand-operated vacuum pump with accessories -V.A.G 1390- and water drainage container -V.A.G 1390/1- to return hose -2-.
– Operate diesel extractor -VAS 5226 - or hand-operated vacuum pump -V.A.G 1390- until no more fuel comes out of return hose. Be careful that no fuel is sucked into hand-operated vacuum pump.



– Pull vacuum line from brake servo -1- off tandem pump -4-.
– Pull supply hose -2- (white marking) and return hose -3- (blue marking) off tandem pump -4-.
– Unbolt securing bolts -arrow-.
– Remove tandem pump -4- from cylinder head.



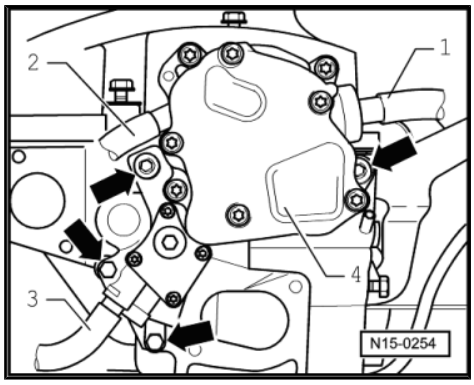
4.4.2 Installing

Install in reverse order. In the process, note the following:

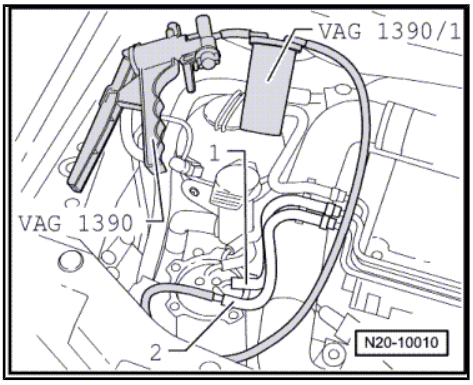
Note

- *Ensure that tandem pump coupling seats properly in camshaft.*
- *Always renew tandem pump seals.*

– Install tandem pump and tighten top securing bolts to 20 Nm.
– Tighten bottom securing bolts to 10 Nm.
– Attach return hose (blue marking) to return connection -3- of tandem pump.
– Connect supply line (white marking) to the supply connection -2- and the vacuum line of brake servo -1- to the tandem pump -4-.
– Connect supply hose (white marking) to the fuel filter.



– Connect diesel extractor -VAS 5226 - or hand-operated vacuum pump with accessories -V.A.G 1390- and water drainage container -V.A.G 1390/1- to return hose -2-.
– Operate diesel extractor -VAS 5226 - or hand-operated vacuum pump -V.A.G 1390- until fuel comes out of return hose. Be careful that no fuel is sucked into hand-operated vacuum pump.
– Attach return hose (blue marking) to fuel filter.



5 Electronic power control (EPC)

5.1 Function of EPC system

With the EPC system, the throttle valve is not operated by a cable. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is transmitted to the engine control unit by two accelerator pedal position senders (variable resistors together in one housing) connected to the accelerator pedal.

The position of the accelerator pedal (driver's requirement) is a main input value for the engine control unit.

The throttle valve is actuated by a servomotor (throttle valve positioner) in the throttle valve control part over the full range of engine speeds and load conditions.

The throttle valve is operated by the throttle valve positioner, which is controlled by the engine control unit.

When the engine is not running and the ignition is switched on, the engine control unit moves the throttle valve exactly as prescribed by the accelerator pedal position sender. That is, when the accelerator is depressed halfway, the throttle valve positioner opens the throttle valve by the same amount. The throttle is then approximately half open.

When the engine is running (under load), the engine control unit can open or close the throttle valve independently of the accelerator pedal position sender.

This means that the throttle valve can already be completely open even though the accelerator pedal is only depressed half way. This has the advantage of preventing throttling losses at the throttle valve.

After evaluating the torque requirements of various components (e.g. air conditioning system, automatic gearbox, ABS/ESP...), the engine control unit calculates the optimal throttle valve opening angle for the respective situation.

This also results in significantly improved consumption and exhaust emission values under certain load conditions.

“EPC” is a system comprising all components which contribute to determining, controlling or monitoring the position of the throttle valve, e.g. accelerator pedal position sender, the throttle valve control module, the EPC warning lamp, the engine control unit and so on.

5.2 Assembly overview - accelerator pedal module

1 - Connector

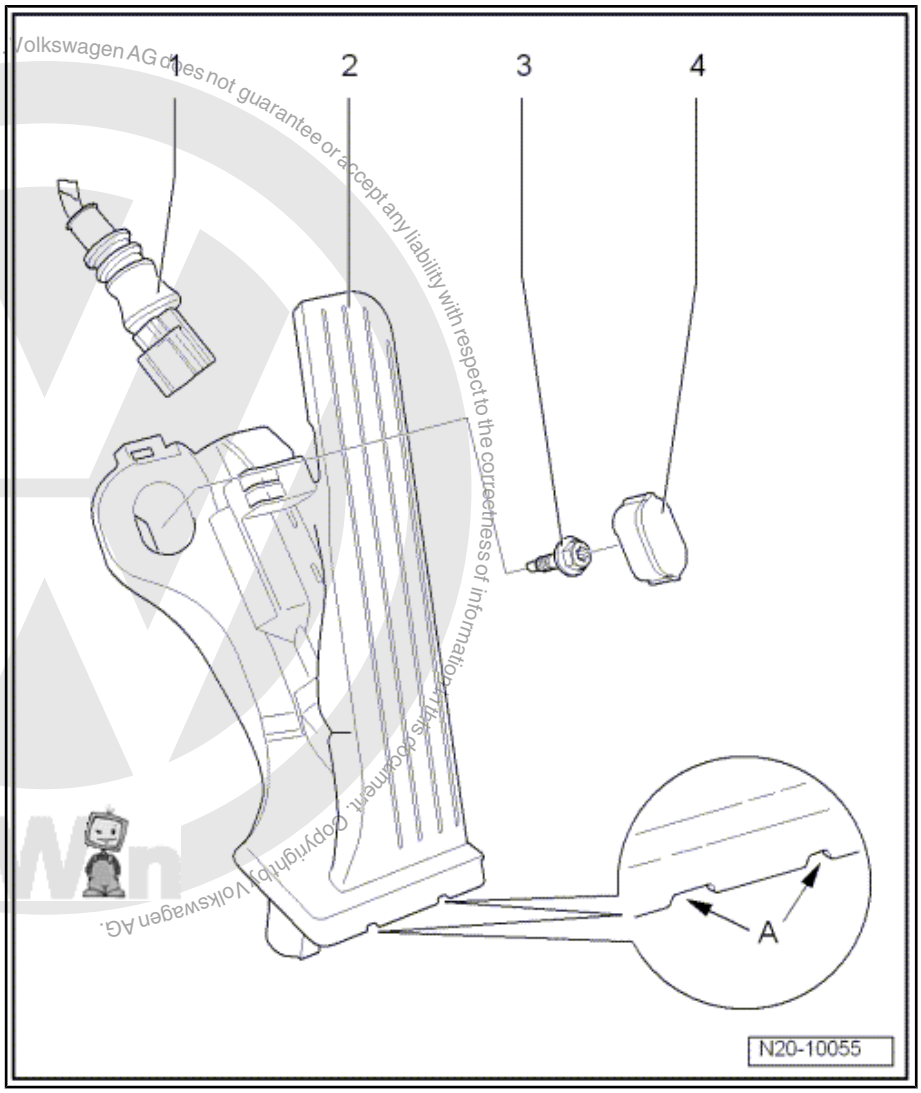
- ❑ Black, 6-pin

2 - Accelerator pedal position sender -G79- and accelerator pedal position sender 2 -G185-

- ❑ Not adjustable
- ❑ The accelerator position sender passes the position of the accelerator on to the engine control unit.
- ❑ -A- Openings for release tool -T10238- or release tool - T10240-
- ❑ Removing and installing ⇒ page 171 .

3 - 10 Nm

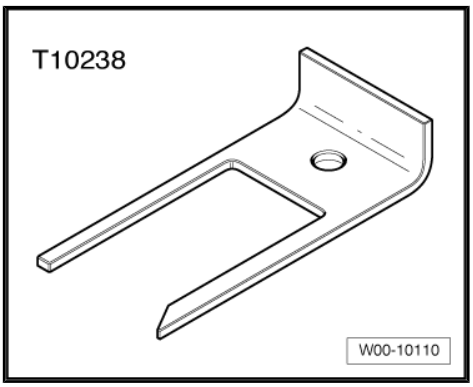
4 - Cap



5.3 Removing and installing accelerator pedal module

Special tools and workshop equipment required

- ♦ Release tool -T10238- or release tool -T10240-

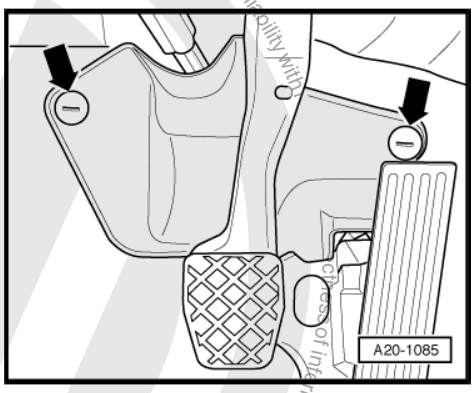


Removing

– Remove steering column cover -arrows-.

– Lever out cap ⇒ Item 4 (page 171) using a screwdriver.

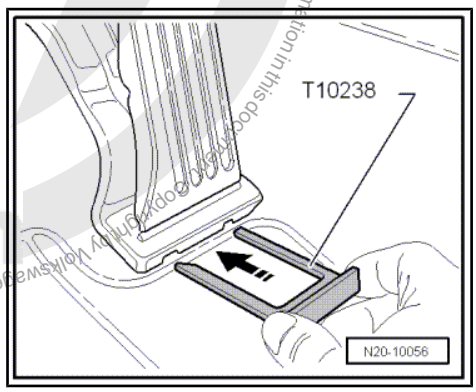
– Remove securing bolt ⇒ Item 3 (page 171) .



Release accelerator pedal module

– Push release tool -T10238 - (for right-hand drive vehicles release tool -T10240-) into intended holes as shown to stop and remove accelerator pedal module.

– Separate electrical connection and pull wiring guide off accelerator pedal module.



Installing

– Fit connector -2- to the accelerator pedal module -5- and slide the rubber grommet -1- onto the connector again.

– Press accelerator pedal module onto securing pins -6-.

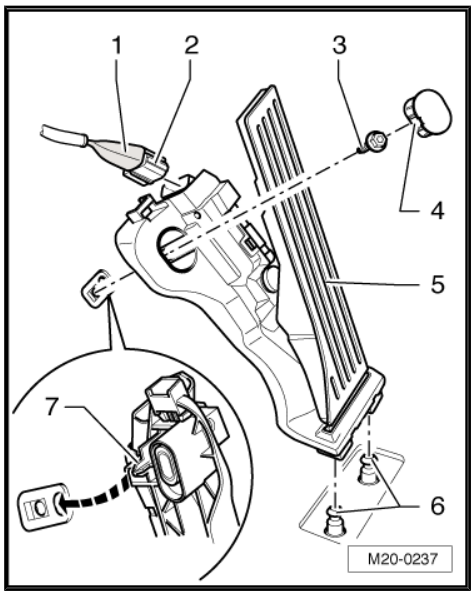
– Insert centring pin -7- into hole in floor of vehicle.

– Secure accelerator pedal module with the bolt -3- and fit cover cap -4-.

– Install steering column trim.

– If the accelerator pedal module has been renewed, adapt the accelerator pedal module to the engine control unit⇒ Vehicle diagnosis, testing and information system -VAS 5051B- “Guided functions”.

– If the accelerator pedal module has been renewed on vehicles with automatic gearbox or direct shift gearbox, the kick-down function must be programmed ⇒ Vehicle diagnosis, testing and information system -VAS 5051B- Guided functions“”.



Tightening torque:

Component	Nm
Accelerator pedal module to body	10

21 – Turbocharging/supercharging

1 Charge air system with turbocharger

1.1 Safety precautions

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, coolant, refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *Ensure that there is sufficient clearance to all moving or hot components.*

Observe following if test and measuring instruments are required during a road test:

WARNING

- *Test and measuring instruments must be secured to rear seat and operated by a second person from this location.*
- *If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat will receive serious injuries when the airbag is triggered.*

1.2 Rules for cleanliness

When working on the turbocharger, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all joints and surrounding areas before dismantling.
- Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes, etc.).

- Existing transport and protective packaging and sealing caps must only be removed immediately prior to installation.
- When making repairs, remove oil from connection and hose ends.
- When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

2 Charge air system with turbocharger, engine codes BKC, BXE

Observe safety precautions ⇒ page 173

Observe rules for cleanliness ⇒ page 173

Hose connections ⇒ page 200

Turbocharger - Assembly overview, engine codes BKC, BXE ⇒ page 175

Removing and installing turbocharger, engine codes BKC, BXE ⇒ page 177

Parts of charge air cooling - Assembly overview, engine codes BKC, BXE ⇒ page 183

Removing and installing charge air cooler ⇒ page 202

Checking charge air system for leaks ⇒ page 204

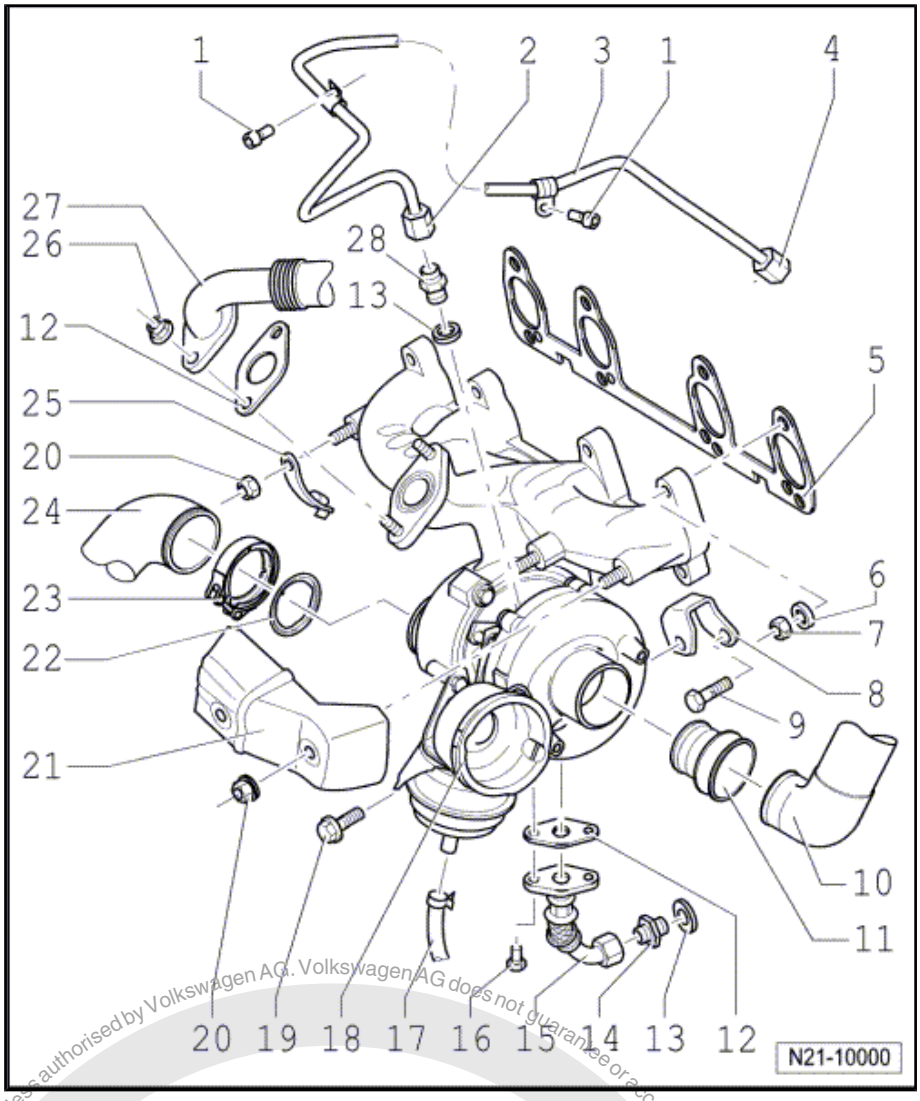
2.1 Turbocharger - Assembly overview, engine codes BKC, BXE

Note

- *All hose connections are secured.*
- *Charge air system must be free of leaks.*
- *Renew self-locking nuts.*
- *Before screwing on oil supply line, fill turbocharger at connection with engine oil.*
- *After installing turbocharger, run engine for about 1 minute at idling speed to insure that oil is supplied to turbocharger.*

Observe safety precautions ⇒ page 173 .

Observe rules for cleanliness ⇒ page 173 .



1 - 10 Nm

2 - Union nut, 22 Nm

3 - Oil supply line

- ❑ Before installing oil supply line, ensure that it is not blocked.
- ❑ Before installing, fill turbocharger with engine oil through oil supply line connection.
- ❑ Removing and installing ⇒ page 114 .

4 - Union nut, 22 Nm

5 - Seal

- ❑ Renew.
- ❑ Note installation position.

6 - Washer

7 - 25 Nm

- ❑ Renew.

8 - Support

- ❑ Between turbocharger and cylinder block

9 - 40 Nm

- ❑ First hand tighten all bolts.

10 - Connecting pipe

- ❑ Air filter/turbocharger

11 - Connector

12 - Seal

- ❑ Renew.

13 - Oil seal

- ❑ Renew.

14 - Pipe union, 40 Nm

15 - Oil return line

- ❑ To cylinder block.
- ❑ Tighten union nut to 30 Nm

16 - 17 Nm

17 - Vacuum hose

- ❑ To solenoid valve block.

18 - Turbocharger

- ❑ Can only be renewed with exhaust manifold.
- ❑ To remove turbocharger take right-hand drive shaft off ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shaft; Removing and installing drive shafts .

19 - 20 Nm

- ❑ First hand tighten all bolts.

20 - 20 Nm

- ❑ Renew.

21 - Heat shield

22 - Seal

- ❑ Renew.
- ❑ Note installation position.

23 - Clamp, 7 Nm

24 - Front exhaust pipe

25 - Retainer

- ❑ For oil supply line ⇒ Item 3 (page 176) .
- ❑ Before installing, secure oil supply pipe.

26 - 22 Nm

- ❑ Renew.

27 - Connecting pipe

- ❑ To bypass flap.

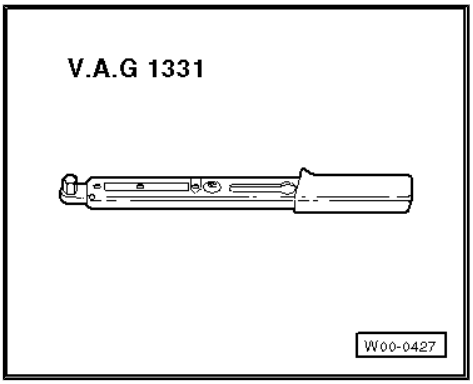
28 - Pipe union, 30 Nm

- ❑ Renew.
- ❑ Coat threads and bolt head contact surface with hot bolt paste -G 052 112 A3- .

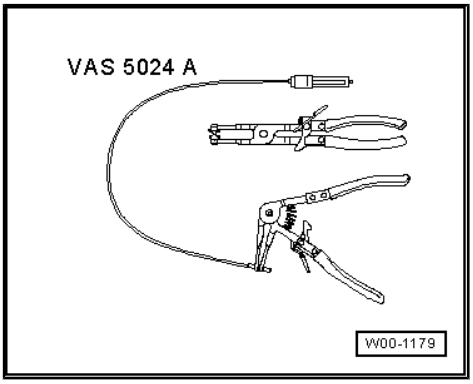
2.2 Removing and installing turbocharger, engine codes BKC, BXE

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331-



- ♦ Spring-type clip pliers -VAS 5024A-



Caution

If mechanical damage is found on the turbocharger, e.g. a broken compressor wheel, it is not sufficient to replace the turbocharger. To prevent further damage, carry out the following repairs:

- *Check air cleaner housing, air filter insert and intake hoses for dirt.*
- *Check entire charge air duct and charge air cooler for foreign bodies.*

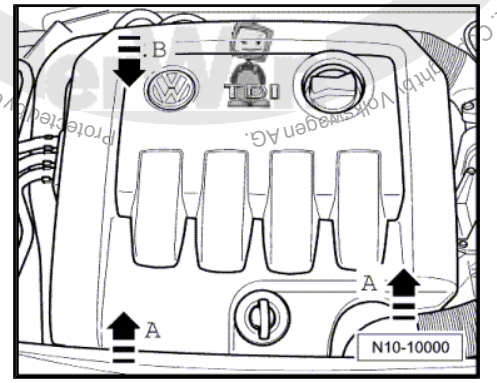
If foreign bodies are found in the charge air system, the charge air duct must be cleaned and the charge air cooler renewed if necessary.

Removing ⇒ page 178

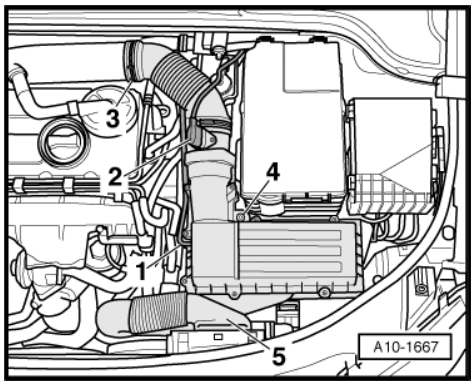
Installing ⇒ page 182

2.2.1 Removing

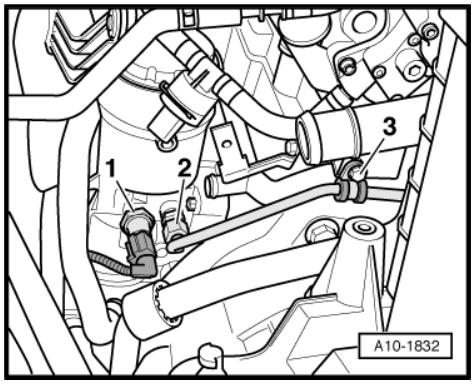
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- and air duct hoses -3- and -5- off.
– Unscrew bolt -4- and take off air filter housing.



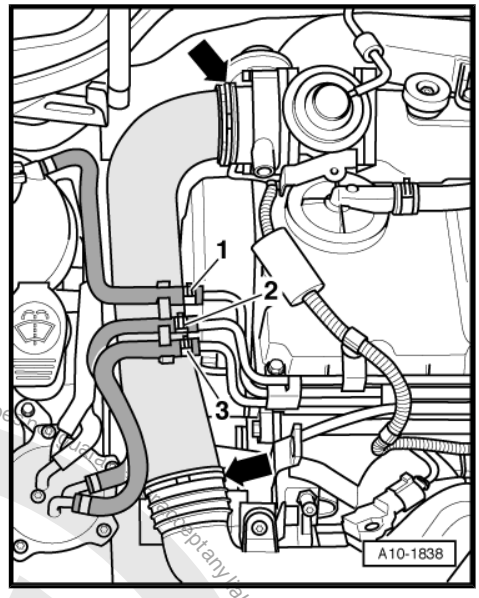
– Disconnect connector -1- on oil pressure switch -F1- .
– Remove oil pressure switch -2-.
– Remove oil supply pipe on retainer -3-.



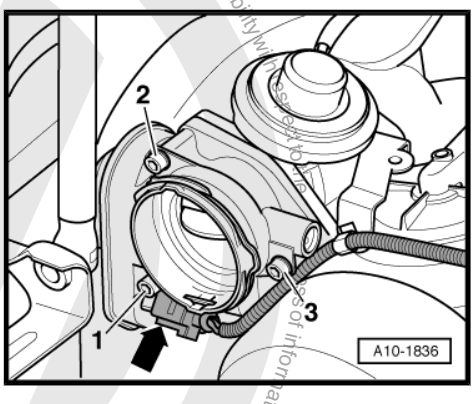
Note

The hoses -1- up to -3- remain connected.

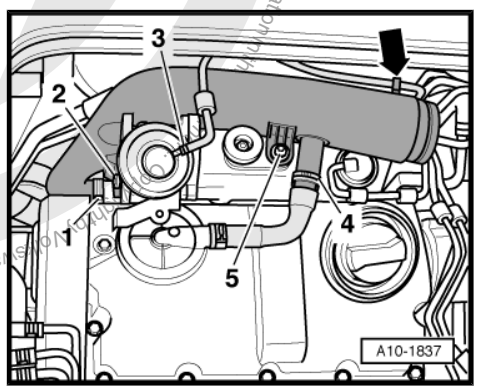
– Place hoses -1- up to -3- on air duct pipe to side.
– Remove air pipe. To do this lift retaining clips -arrow- lightly.



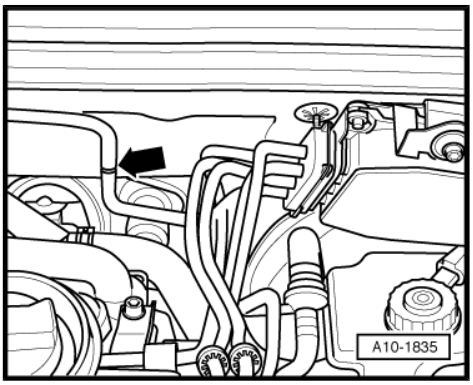
– Disconnect connector -arrow- on intake manifold flap motor -V157- .
– Remove bolts -1 ... 3- and take intake manifold flap motor -V157- off.



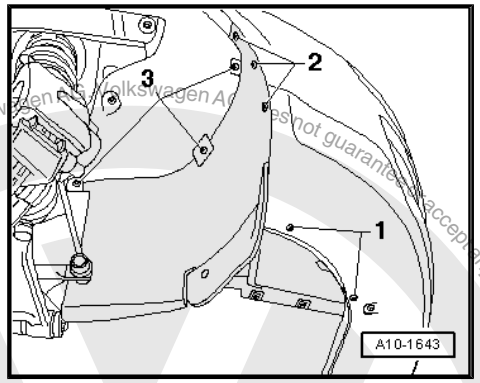
– Disconnect vacuum hose -3- on exhaust gas recirculation valve -N18- .
– Pull pipe to crankcase breather -4- off air duct pipe.
– Loosen spring-type clip -1- on turbocharger using spring-type clip pliers -VAS 5024A- .
– Remove bolts -2- and -5- and take air duct pipe off.
– Free vacuum hoses -arrow-.



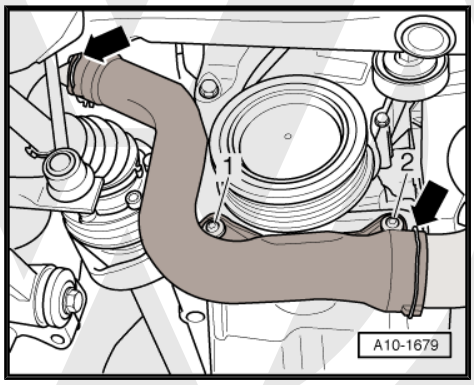
– Separate hose to vacuum unit for charge pressure control on separating point -arrow-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .



– Remove bolts -1 … 3- and remove right-hand sound insulation.



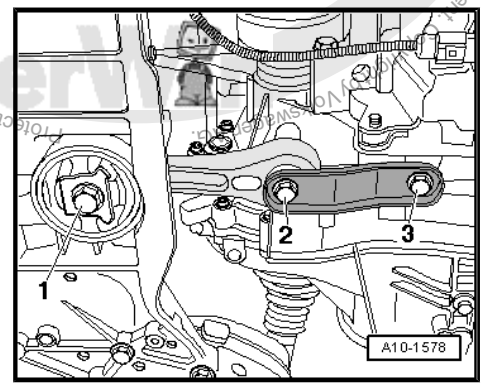
– Remove bolts -1- and -2-.
– Remove right air duct pipe. To do this lift retaining clips -arrow- lightly.
– Take right-hand drive shaft off gearbox flange ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shaft; Removing and installing drive shafts .
– Remove front exhaust pipe ⇒ page 254



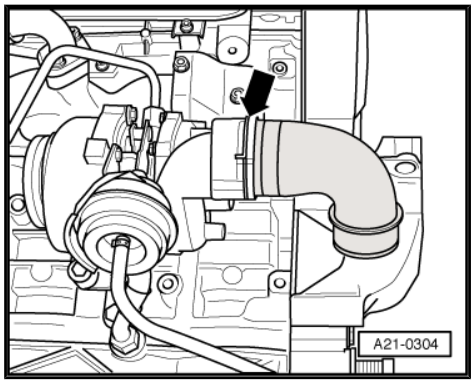
Note

Do not remove bolt -1-.

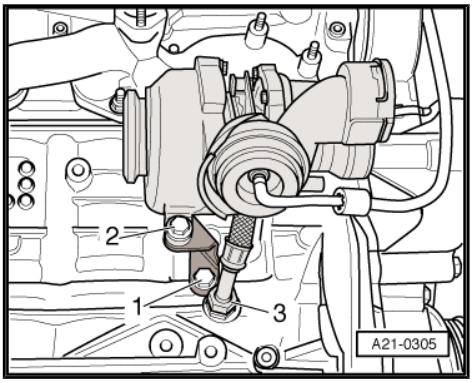
– Remove bolts -2- and -3- on pendulum support.



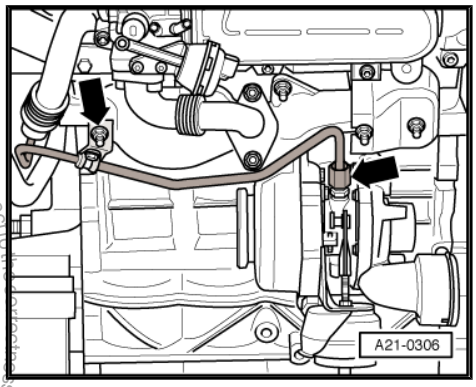
– Remove air hose from turbocharger. To do this lift retaining clip -arrow- lightly.



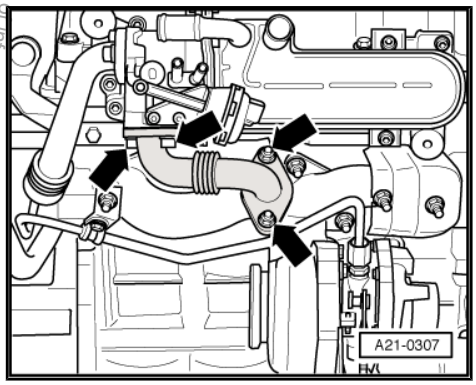
– Remove oil return pipe -3- at cylinder block.



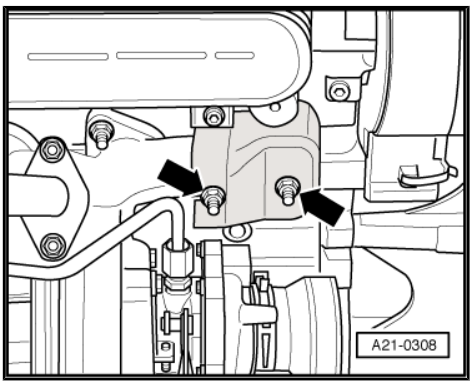
– Remove oil supply pipe on exhaust manifold -arrows- and place to side.



– Remove connecting pipe for exhaust gas recirculation -arrows-.

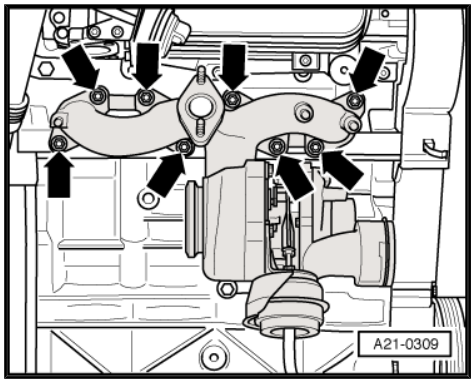


– Remove heat shield from exhaust manifold -arrows-.



– Remove nuts -arrows-.

– Press engine forwards (second mechanic) and take exhaust manifold/turbocharger between subframe and body out.



2.2.2 Installing

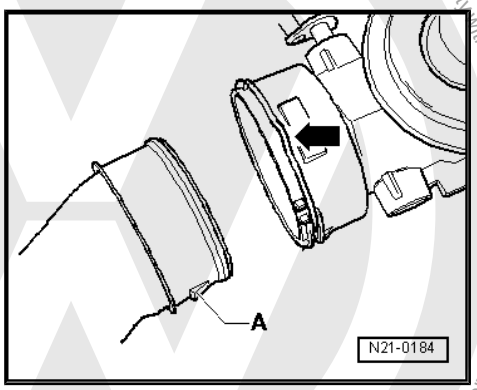
Install in reverse order. In the process, note the following:

Note

- *Renew seals, gaskets and self-locking nuts.*
- *Fill turbocharger with engine oil at connection for oil supply line.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*

– Install exhaust system and align free of stress ⇒ page 248 .

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.



Torque settings ⇒ page 175 .

– Observe installation sequence of the oil supply pipe ⇒ page 114 .

– Install pendulum support ⇒ page 23

– Check engine oil level ⇒ page 97 .

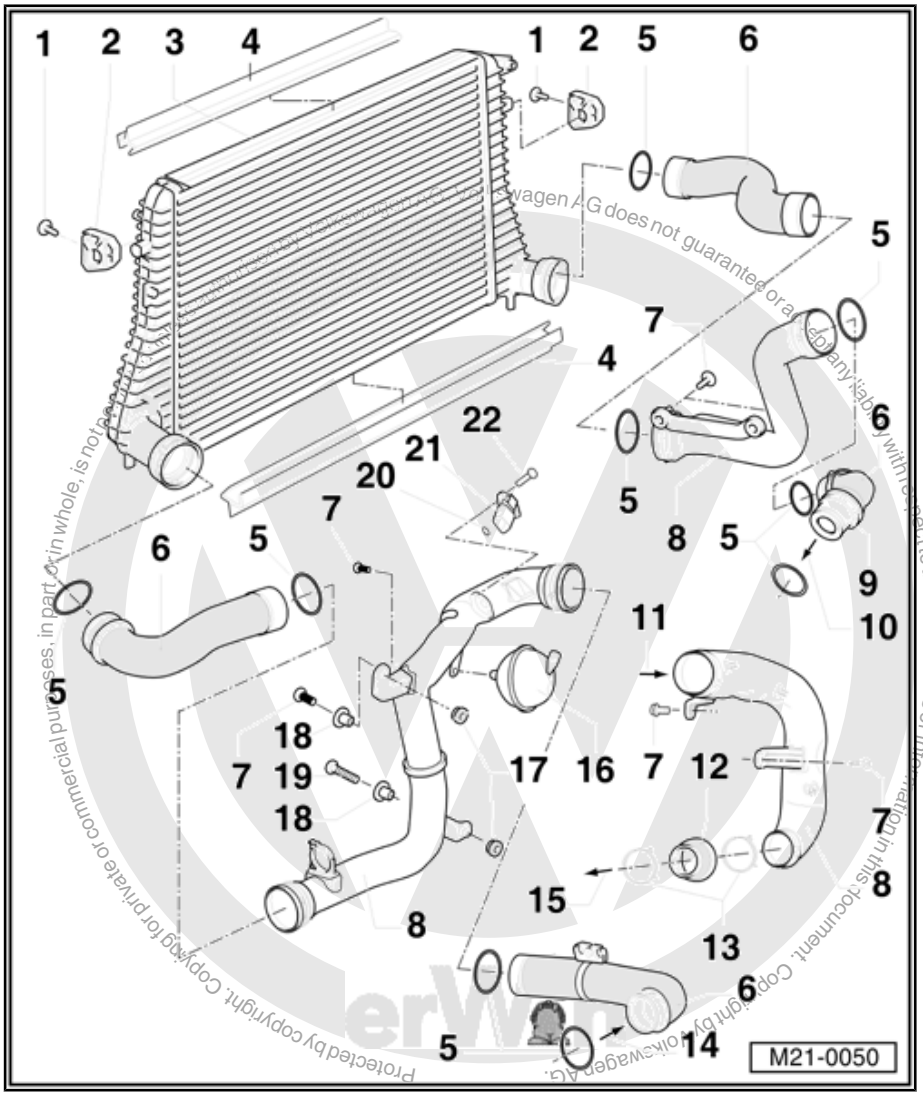
Note

After installing turbocharger, run engine for about 1 minute at idling speed and do not rev up immediately, this ensures that the turbocharger is supplied with oil.

2.3 Parts of charge air cooling - Assembly overview, engine codes BKC, BXE

Note

- *Charge air system must be free of leaks.*
- *For assembly use lubricant (water without additive) if necessary. Do not use lubricants containing oil.*
- *When making repairs, remove oil from connection and hose ends.*
- *All charge air system hose connections are secured by spring-type clips or by connector couplings.*
- *Checking charge air system for leaks* ⇒ page 204



1 - 8 Nm
- ❑ Location ⇒ page 184

2 - Retainer
- ❑ Note installation position.

3 - Charge air cooler

4 - Seal

5 - O-ring
- ❑ Renew if damaged.

6 - Connecting hose

7 - 8 Nm

8 - Connecting pipe

9 - Silencer

10 - From turbocharger

11 - From air filter

12 - Connector

13 - Hose clip

14 - To intake manifold

15 - To turbocharger

16 - Vacuum reservoir

17 - Sleeve

18 - Grommet

19 - 15 Nm

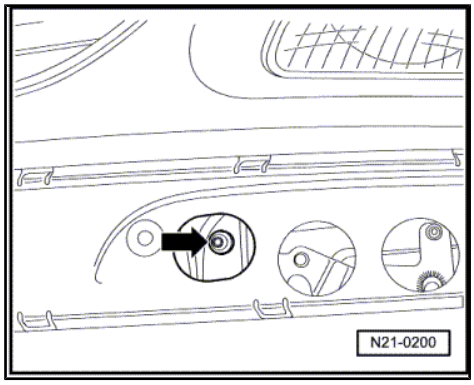
20 - Oil seal
- ❑ Renew if damaged.

21 - Charge air pressure sender -G31- with intake air temperature sender -G42-

22 - 3 Nm

Securing bolts for charge air cooler

To loosen and tighten the securing bolts -arrow- remove bumper cover ⇒ General body repairs, exterior;; Rep. Gr. 63 ; Front bumper .



3 Charge air system with turbocharger, engine codes BLS, BRM

Observe safety precautions ⇒ page 173

Observe rules for cleanliness ⇒ page 173

Hoses with quick release coupling ⇒ page 200

Turbocharger - Assembly overview, engine codes BLS (without diesel particulate filter), BRM ⇒ page 185

Removing and installing turbocharger, engine codes BLS (without diesel particulate filter), BRM ⇒ page 188

Turbocharger - Assembly overview, engine code BLS (with diesel particulate filter) ⇒ page 195

Removing and installing turbocharger, engine code BLS (with diesel particulate filter) ⇒ page 196

Parts of charge air cooling - Assembly overview, engine codes BLS, BRM ⇒ page 198

Removing and installing charge air cooler ⇒ page 202

Checking charge air system for leaks ⇒ page 204

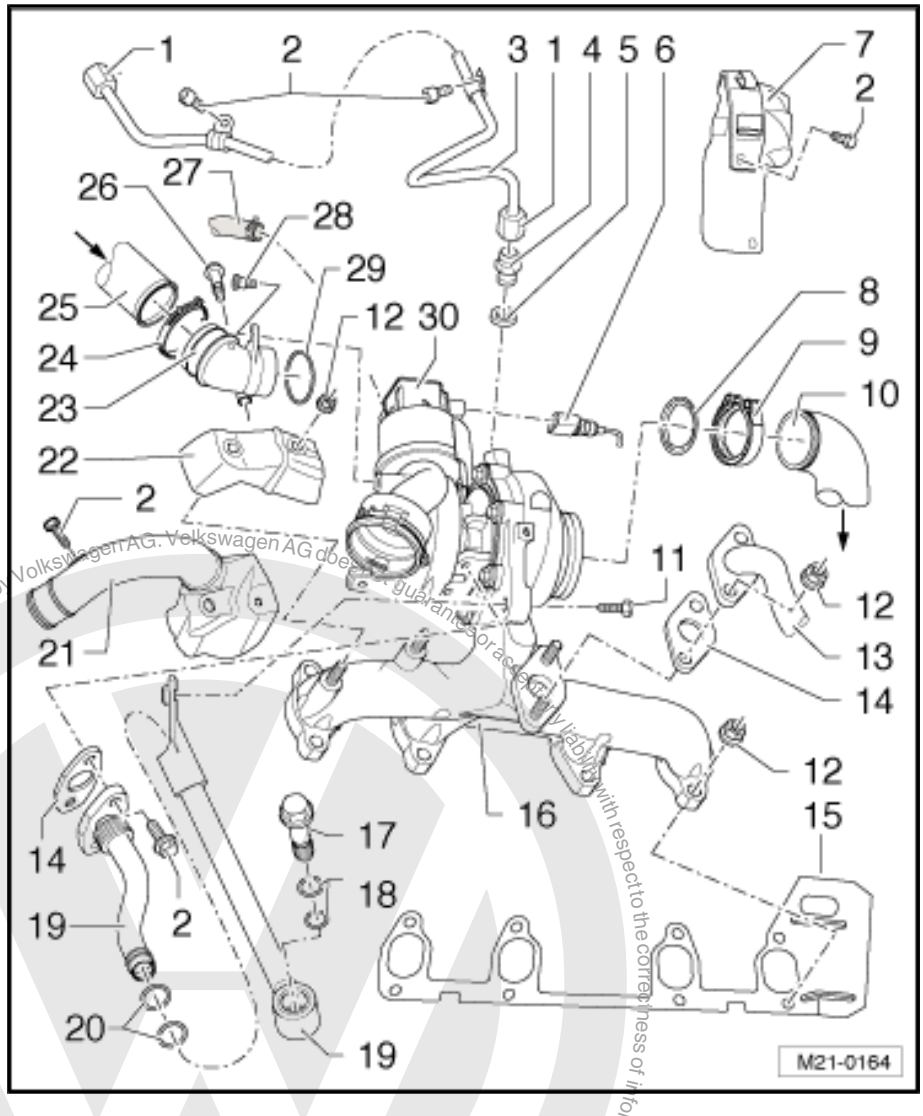
3.1 Turbocharger - Assembly overview, engine codes BLS (without diesel particulate filter), BRM

Note

- *All hose connections are secured.*
- *Charge air system must be free of leaks.*
- *Renew self-locking nuts.*
- *Before screwing on oil supply line, fill turbocharger at connection with engine oil.*
- *After installing turbocharger, run engine for about 1 minute at idling speed to insure that oil is supplied to turbocharger.*

Observe safety precautions ⇒ page 173 .

Observe rules for cleanliness ⇒ page 173 .



1 - Union nut, 22 Nm

2 - 10 Nm

3 - Oil supply line

- ❑ Before installing oil supply line, ensure that it is not blocked.
- ❑ Before installing, fill turbocharger with engine oil through oil supply line connection.
- ❑ Removing and installing ⇒ page 114 .

4 - Pipe union, 30 Nm

- ❑ Renew.
- ❑ Coat threads and bolt head contact surface with hot bolt paste -G 052 112 A3- .

5 - Oil seal

- ❑ Renew.

6 - Connector

- ❑ For loading shovel position sender -G500-
- ❑ Applies only to engine: BRM

7 - Heat shield

- ❑ With retainer for lambda probe wiring harness

8 - Seal

- ❑ Renew.
- ❑ Note installation position.

9 - Clamp, 7 Nm

10 - Front exhaust pipe

11 - 25 Nm

12 - 25 Nm

- ❑ Renew.

13 - Connecting pipe

- ❑ To exhaust gas recirculation cooler.

14 - Seal

- ❑ Renew.

15 - Seal

- ❑ Renew.
- ❑ Note installation position.

16 - Turbocharger

- ❑ Can only be renewed completely with exhaust manifold and loading shovel position sender -G500-

17 - Banjo bolt, 60 Nm

- ❑ Renew.

18 - O-ring

- ❑ Renew.

- ❑ Before installing apply a thin coat of clean engine oil.

19 - Oil return line

- ❑ To cylinder block.
- ❑ Removing and installing complete

20 - O-ring

- ❑ Separate and renew oil return line only when leaking
- ❑ Before installing apply a thin coat of clean engine oil.

21 - Air duct

- ❑ To air filter
- ❑ For hot air intake.
- ❑ For cold country equipment only
- ❑ Installed instead of the shield ⇒ Item 22 (page 187)

22 - Heat shield

23 - Connecting pipe

24 - Hose clip

25 - Connecting hose

26 - 8 Nm

- ❑ Renew.

27 - Vacuum hose

28 - 4 Nm

29 - O-ring

- ❑ Renew.

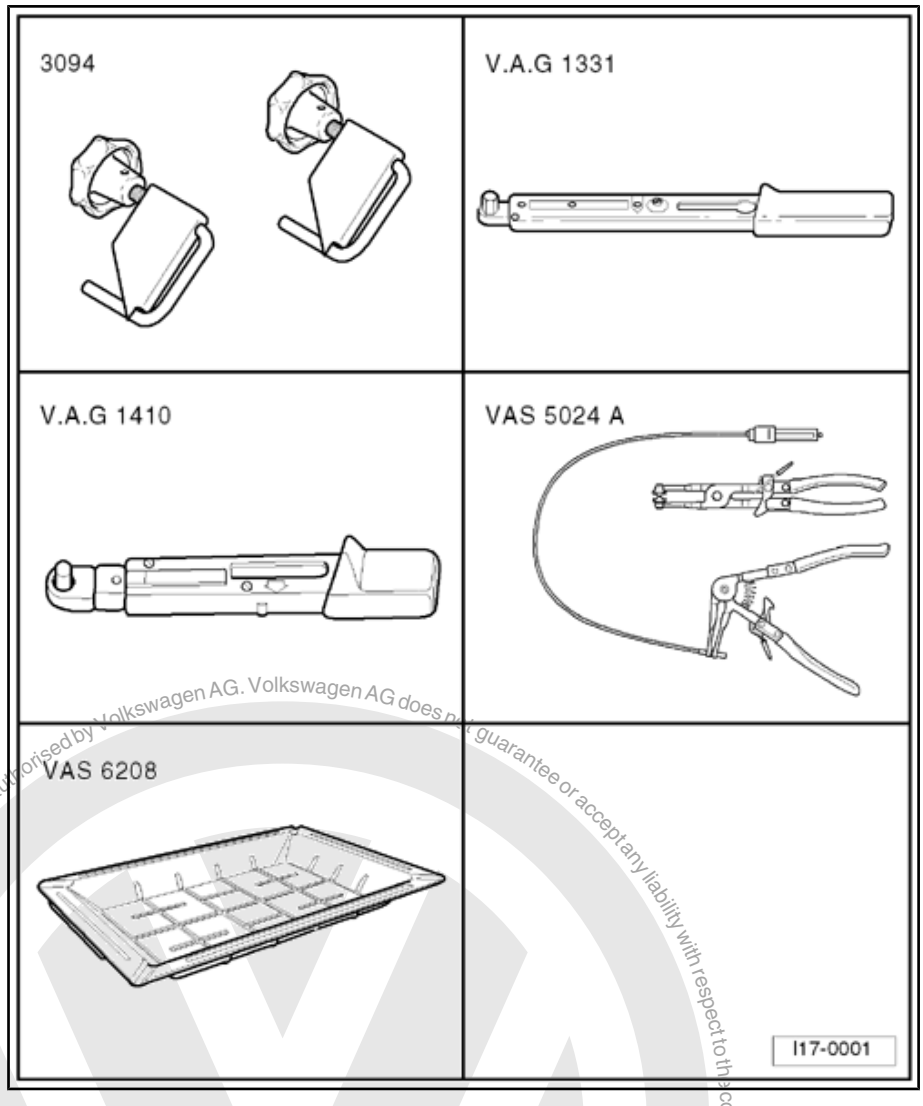
30 - Turbocharger guide vane position sender -G500-

- ❑ Applies only to engine: BRM

3.2 Removing and installing turbocharger, engine codes BLS (without diesel particulate filter), BRM

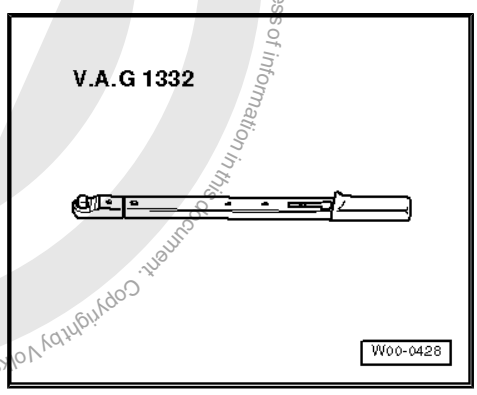
Special tools and workshop equipment required

- Hose clamps to Ø 25 mm -3094-
- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1410-
- Spring-type clip pliers -VAS 5024A-
- Drip tray for workshop hoist -VAS 6208 -



Special tools and workshop equipment required

- Torque wrench -V.A.G 1332-



Caution

If mechanical damage is found on the turbocharger, e.g. a broken compressor wheel, it is not sufficient to replace the turbocharger. To prevent further damage, carry out the following repairs:

- *Check air cleaner housing, air filter insert and intake hoses for dirt.*
- *Check entire charge air duct and charge air cooler for foreign bodies.*

If foreign bodies are found in the charge air system, the charge air duct must be cleaned and the charge air cooler renewed if necessary.

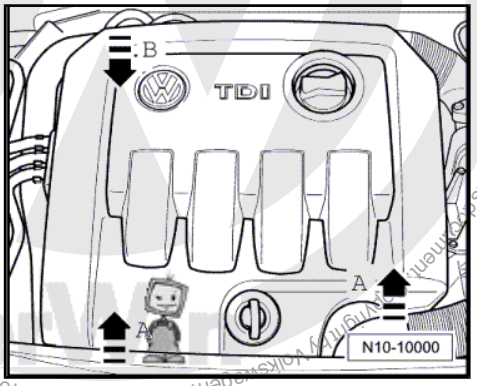
Removing ⇒ page 189

Installing ⇒ page 193

3.2.1 Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Remove air cleaner housing with air mass meter.



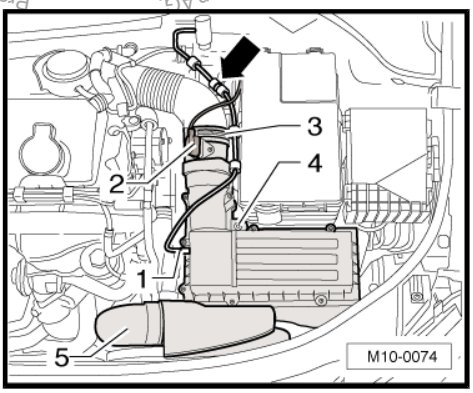
– Disconnect connector -2- on air mass meter -G70- .

– Pull breather hose -1- off and unhook from bracket -arrow-.

– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .

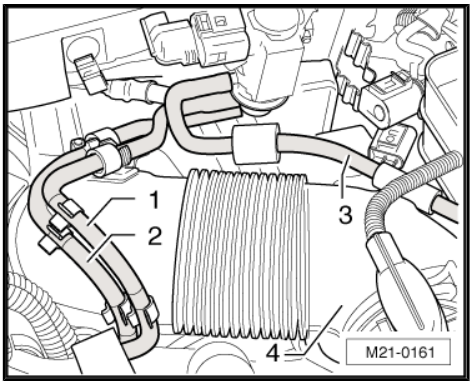
– Pull intake manifold -5- off the air duct.

– Unscrew bolt -4- and take off air filter housing.

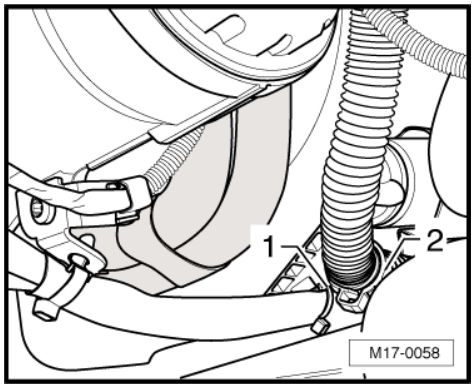


– Pull vacuum hoses -1- to -3- off intake hose -4-.

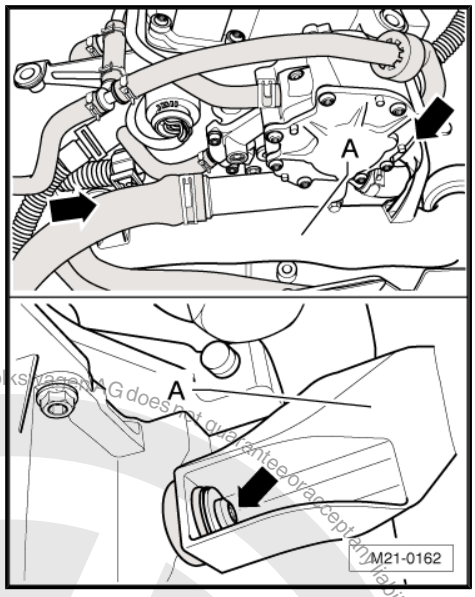
– Remove intake hose -4- on turbocharger.



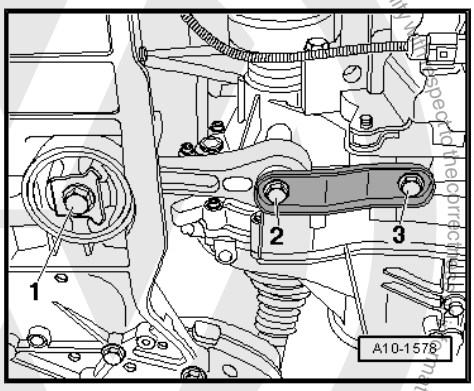
– Carefully cut through cable tie -1-.



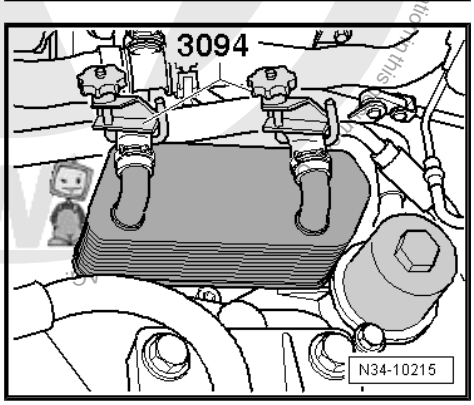
– Remove both bolts -arrows- from upper charge air pipe -A-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Remove the bolt -arrows- of the charge air pipe -A- from the oil sump.
– Remove charge air pipe on turbocharger and pull it forwards as far as possible.



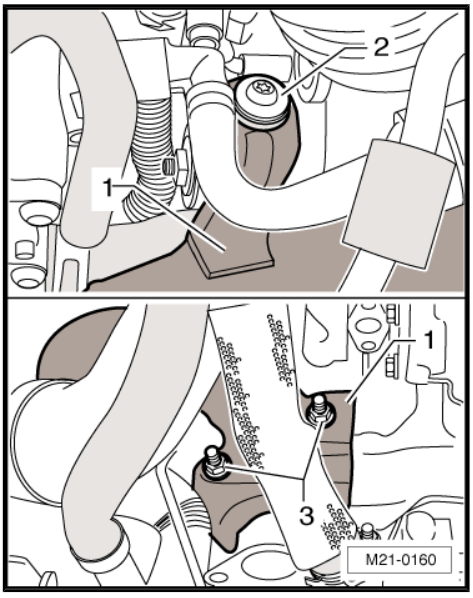
– Unscrew bolts -2- and -3- at pendulum support.



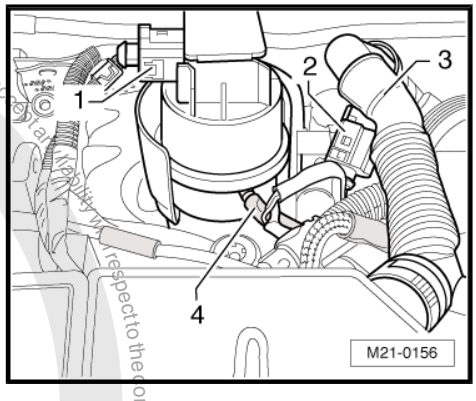
– Clamp coolant hoses of gearbox oil cooler with hose clamps to Ø 25 mm -3094- .



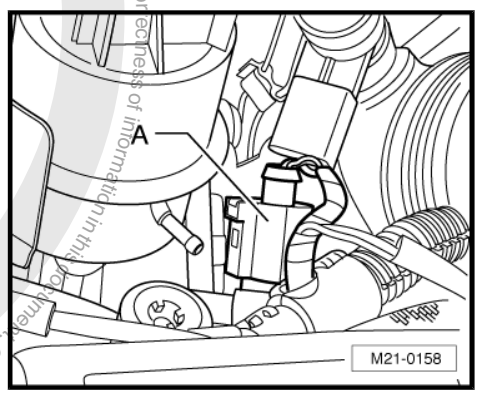
– Unscrew bolt -2- of the air duct.



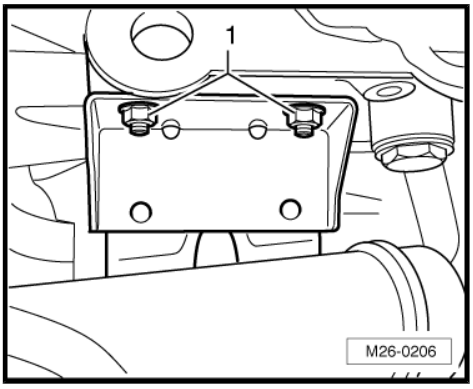
– Release connectors -1- and -2- and pull off.
– Remove hose -3-.
– Detach vacuum hose -4-.



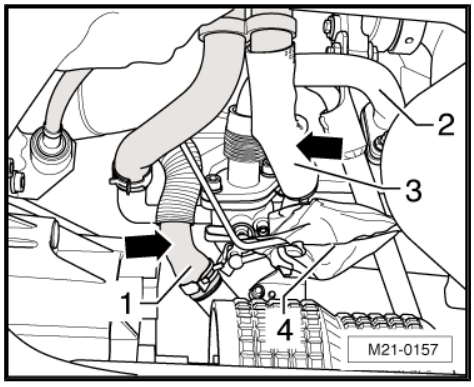
– Release connector -A- and pull off.
– Remove front exhaust pipe ⇒ page 251 .



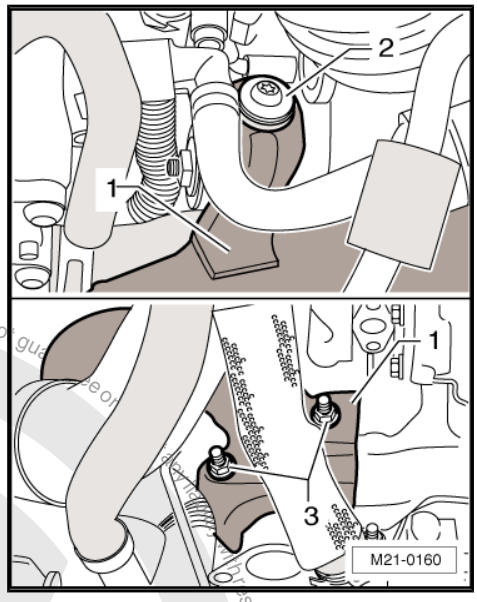
– Remove bracket. To do this remove nuts -1-.
– Remove right-hand drive shaft on gearbox ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .



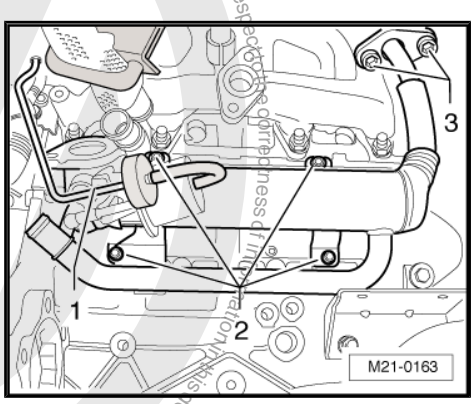
– Disconnect coolant hoses -1- and -3- using hose clamps to Ø 25 mm -3094 - , see -arrows-.
– Open shield -4- and remove.
– Remove connecting pipe -2-.



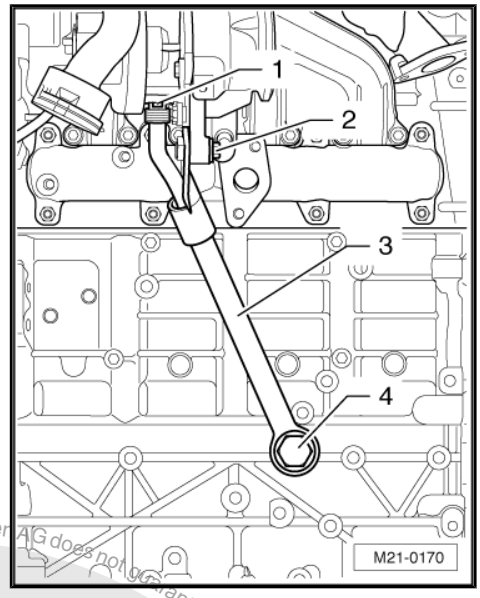
– Remove nuts -3- and take air duct out



– Pull pipe/hose line -1- off.
– Unscrew bolts -2- and -3- and take exhaust gas recirculation cooler off.



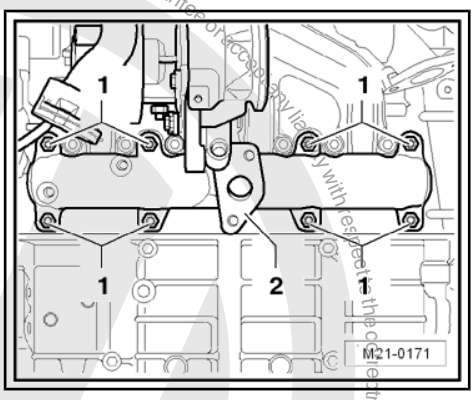
– Remove bolts -1-, -2- and -4- and take oil return line -3- off complete from cylinder block and turbocharger.



Note

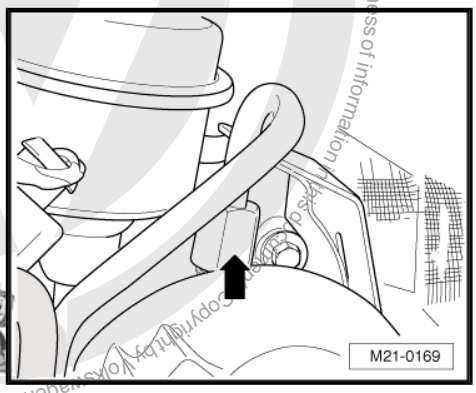
- *Do not take the turbocharger -2- off after having removed the nuts -1- as the oil supply pipe is still connected to the turbocharger.*
- *Let the two loosened nuts -1- onto the threaded studs to prevent the turbocharger from falling.*

– Remove nuts -1- from turbocharger.



– Unscrew union nut -arrow- and pull oil supply pipe off turbocharger.

– Unscrew loosened nuts and take turbocharger off threaded studs.



Note

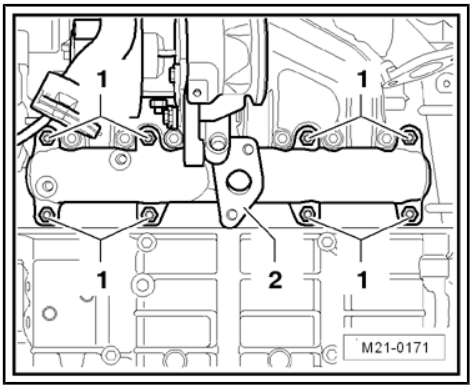
A second mechanic is required for the following work step.

– Press the engine forwards and take turbocharger out downwards.

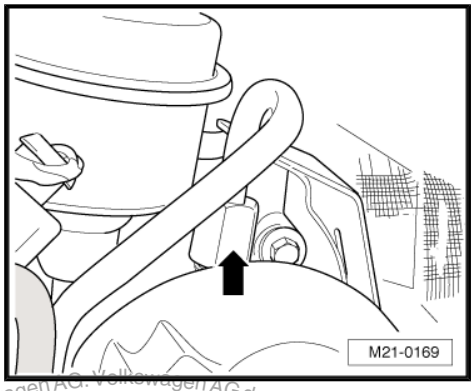
3.2.2 Installing

– Fit the turbocharger -2- on the threaded studs.

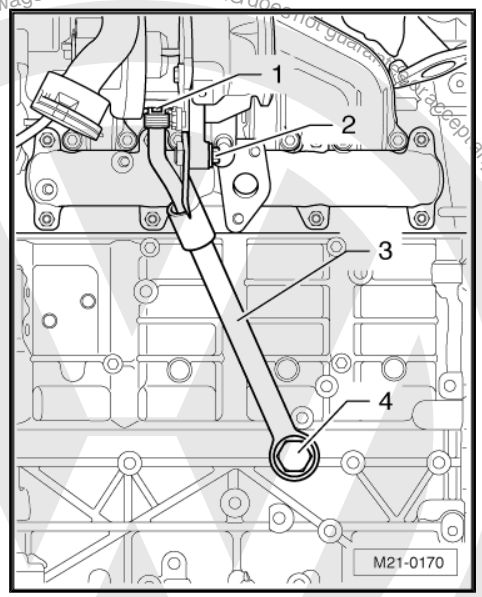
– To prevent turbocharger from falling screw on two new nuts -1- by hand.



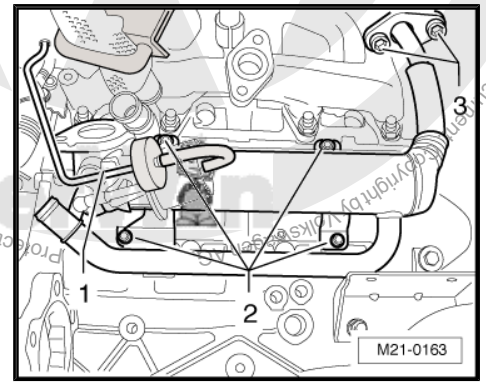
– Fit oil supply line to the turbocharger and fit union nut -arrow-.



– Install oil return line -3- complete.
– Renew bolts -4-.



– First screw all bolts -2- and -3- from exhaust gas recirculation cooler in loosely. Then tighten bolts -2- and -3-.
– Fit pipe/hose line -1- off.

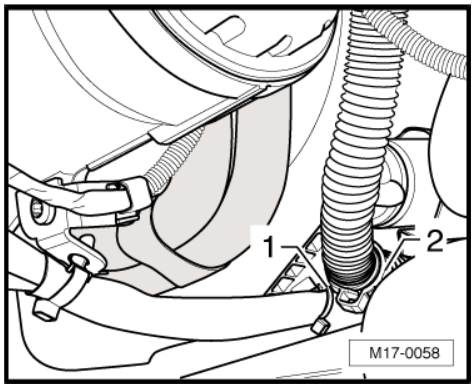


– Renew cable ties -1-.

Further installation is carried out in the reverse order.

Torque settings ⇒ page 185 .

– Fill coolant system with coolant ⇒ page 127 .
– Check engine oil level ⇒ page 97 .
– Fit pendulum support to gearbox ⇒ page 23 .



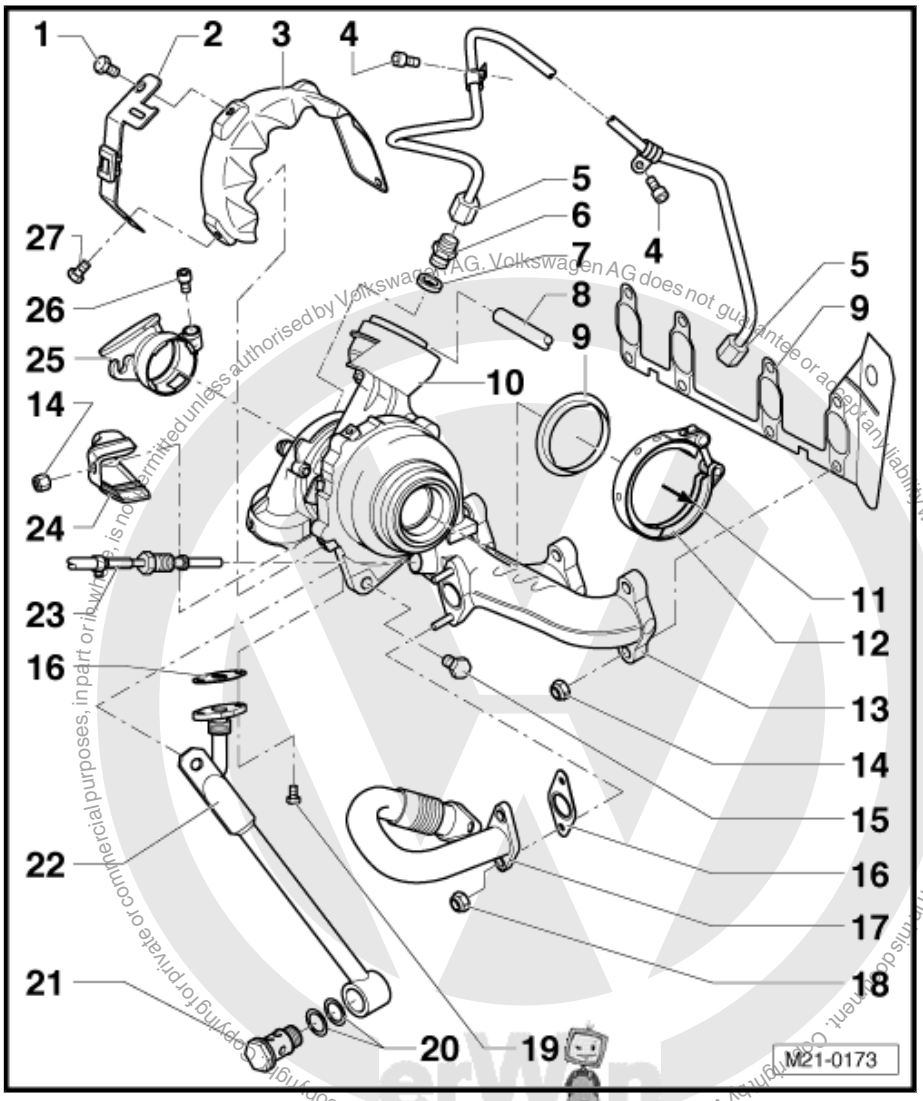
3.3 Turbocharger - Assembly overview, engine code BLS (with diesel particulate filter)

Note

- *All hose connections are secured.*
- *Charge air system must be free of leaks.*
- *Renew self-locking nuts.*
- *Before fitting hose to oil supply line connection, fill turbocharger with engine oil.*
- *After installing turbocharger, run engine for about 1 minute at idling speed to insure that oil is supplied to turbocharger.*

Observe safety precautions ⇒ page 173

Observe rules for cleanliness ⇒ page 173



1 - 10 Nm

2 - Retainer

3 - Heat shield

4 - 10 Nm

5 - Oil supply line

- ❑ With union nut, 22 Nm
- ❑ From turbocharger to oil filter bracket
- ❑ Before installing oil supply line, ensure that it is not blocked.
- ❑ Before installing, fill turbocharger with engine oil through oil supply line connection.
- ❑ Removing and installing ⇒ page 114 .

6 - Pipe union, 30 Nm

- ❑ Renew.
- ❑ Coat threads and bolt head contact surface with hot bolt paste -G 052 112 A3- .

7 - Oil seal

- ❑ Renew.

8 - Vacuum hose

9 - Seal

- ❑ Renew.
- ❑ Note installation position.

10 - Turbocharger

- ❑ Can only be renewed with exhaust manifold.
- ❑ Removing and installing ⇒ page 196 .

11 - To particulate filter

12 - Clamp, 7 Nm

- ❑ For turbocharger/particulate filter

13 - Exhaust manifold

- ❑ Can only be renewed together with turbocharger

14 - 25 Nm

- ❑ Renew.

15 - 25 Nm

16 - Seal

- ❑ Renew.

17 - Connecting pipe

- ❑ For exhaust gas recirculation.
- ❑ Assembly overview - exhaust gas recirculation cooler ⇒ page 265

18 - 25 Nm

- ❑ Renew.

19 - 15 Nm

20 - O-ring

- ❑ Renew.

21 - Banjo bolt, 60 Nm

22 - Support

- ❑ For turbocharger
- ❑ With oil return line

23 - Exhaust gas temperature sender bank 1 -G235- , 45 Nm

- ❑ Lubricate thread of sender using hot bolt paste - G 052 112 A3-

24 - Heat shield

25 - Connection

- ❑ For intake hose for air filter/turbocharger
- ❑ Assembly overview - air filter ⇒ page 237 .

26 - 9 Nm

27 - 10 Nm

3.4 Removing and installing turbocharger, engine code BLS (with diesel particulate filter)

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331-

Caution

If mechanical damage is found on the turbocharger, e.g. a broken compressor wheel, it is not sufficient to replace the turbocharger. To prevent further damage, carry out the following repairs:

- ***Check air cleaner housing, air filter insert and intake hoses for dirt.***
- ***Check entire charge air duct and charge air cooler for foreign bodies.***

If foreign bodies are found in the charge air system, the charge air duct must be cleaned and the charge air cooler renewed if necessary.

Removing

– Pull connector off exhaust gas pressure sensor 1 -G450- ⇒ Item 2 (page 252) in engine compartment and unscrew securing bolts.

– Disconnect connector for bank 1 exhaust gas temperature sender 1 -G235- ⇒ Item 23 (page 196) .

– Separate electrical connectors to particulate filter.

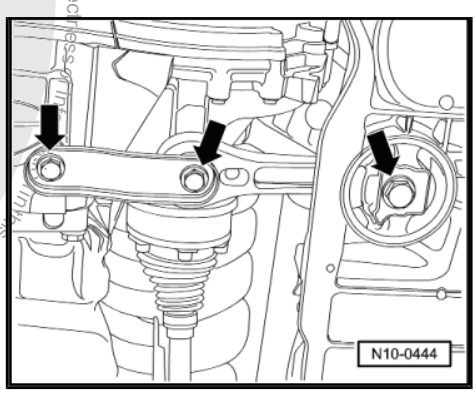
– Remove insulation tray ⇒ General body repairs, exterior; Rep. Gr. 50 .

– Remove subframe and the right drive shaft ⇒ Running gear, axles, steering; Rep. Gr. 40 .

– Remove particulate filter ⇒ page 252 .

– Unscrew coolant pipe for auxiliary heating from cylinder block.

– Unbolt pendulum support -arrows-.



– Remove turbocharger support ⇒ Item 22 (page 196) .

– Remove connecting pipe ⇒ page 262 to exhaust gas recirculation cooler.

– Loosen charge pressure line from turbocharger.

– Pull vacuum hose ⇒ Item 8 (page 195) off turbocharger.

– Loosen oil supply line ⇒ Item 5 (page 195) on turbocharger.

– Unscrew securing bolts for exhaust manifold.

– Tilt the engine forwards in lower mounting and remove turbocharger with exhaust manifold downwards.

Installing

– Install in reverse order.

Note

Torque setting of pendulum support ⇒ page 23 .

3.5 Parts of charge air cooling - Assembly overview, engine codes BLS, BRM

Note

- *Charge air system must be free of leaks.*
- *For assembly use lubricant (water without additive) if necessary. Do not use lubricants containing oil.*
- *When making repairs, remove oil from connection and hose ends.*
- *All charge air system hose connections are secured by spring-type clips or by connector couplings.*
- *Checking charge air system for leaks* ⇒ page 204

1 - 8 Nm
- ❑ Location ⇒ page 199

2 - Retainer
- ❑ Note installation position.

3 - Charge air cooler

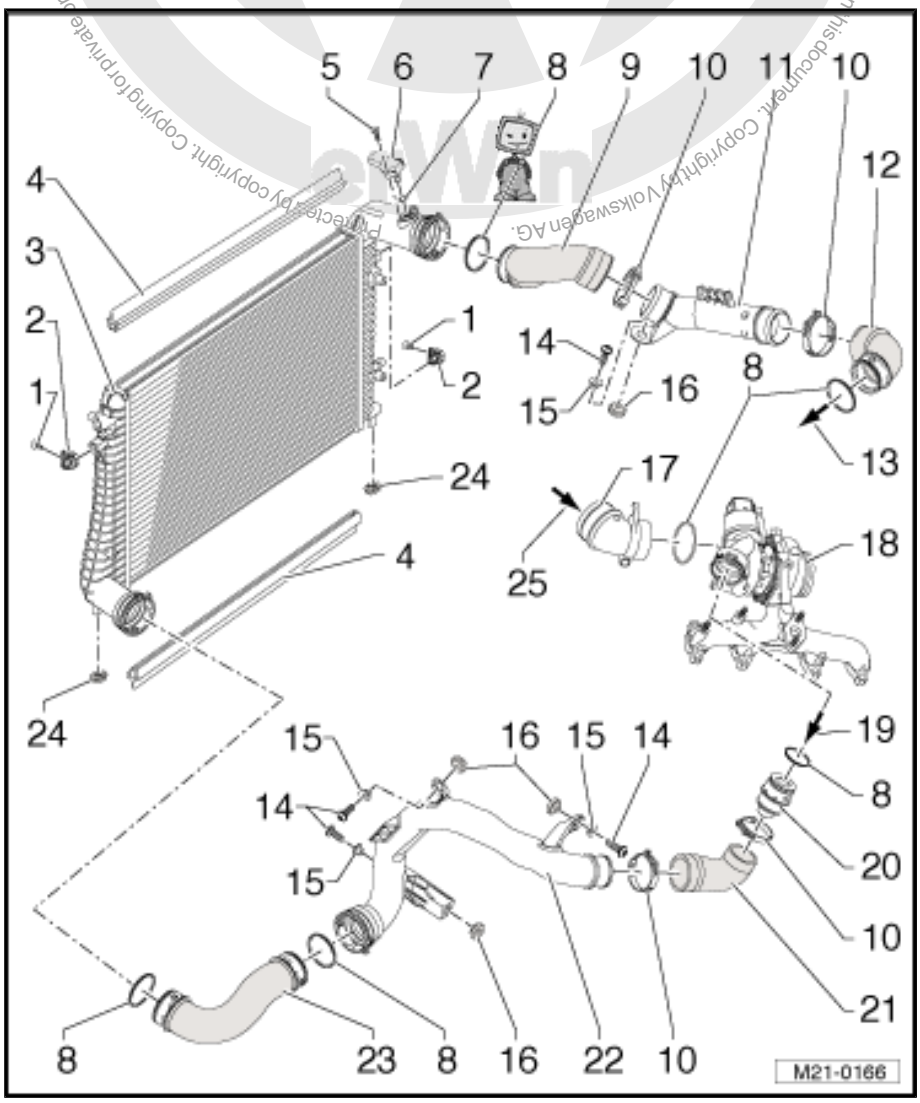
4 - Seal

5 - 3 Nm

6 - Charge air pressure sender -G31- with intake air temperature sender -G42-

7 - Oil seal
- ❑ Renew if damaged.

8 - O-ring
- ❑ Renew if damaged.



9 - Connecting hose

10 - Hose clip

11 - Connecting pipe

12 - Connecting hose

13 - To intake manifold

14 - 8 Nm

15 - Sleeve

16 - Grommet

17 - Connector

18 - Turbocharger

19 - To charge air cooler

20 - Silencer

21 - Connecting hose

22 - Connecting pipe

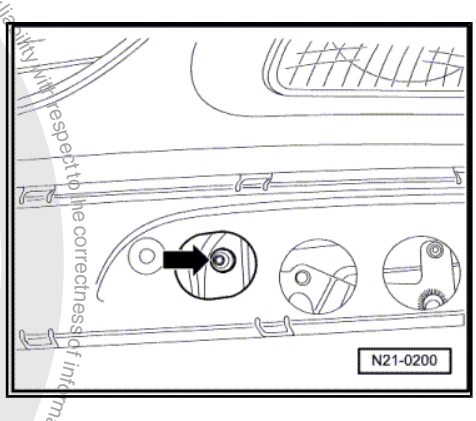
23 - Connecting hose

24 - Bonded rubber mounting

25 - From air filter

Securing bolts for charge air cooler

To loosen and tighten the securing bolts -arrow- remove bumper cover ⇒ General body repairs, exterior;; Rep. Gr. 63 ; Front bumper .



4 Hose connections

4.1 Hose connections

Hoses with quick release coupling ⇒ page 200

Hoses with spring washer ⇒ page 201

4.1.1 Hose connections with connector couplings

WARNING

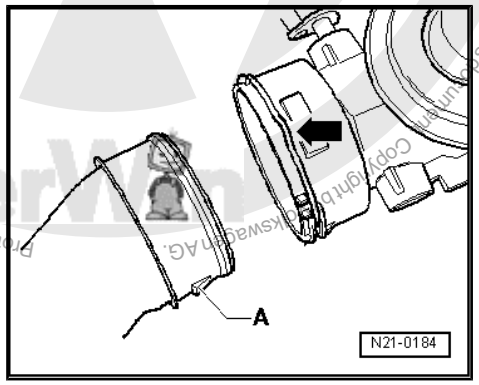
The seal of the connector coupling can be damaged if the securing clip is in locking position when installing. Leaks could occur. Observe installation instructions.

Note

All hoses of the charge air system are secured with hose clips or with quick release couplings. When using quick release couplings the following points must be observed:

Removing

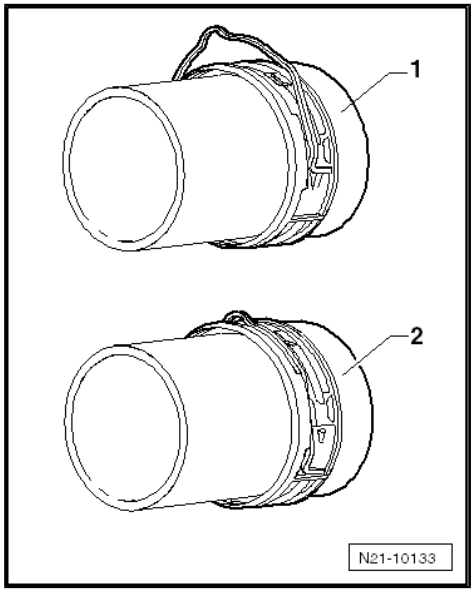
- Unlock quick release coupling by pulling on the securing clip -arrow-.
- Separate hose and pipe without tools.



Installing

- When installing, ensure that locking lugs -A- engage securely.
- If renewed, place seal in groove of charge air hose. Ensure the seal is correctly seated in the groove.
- Oil sealing surface and seal.

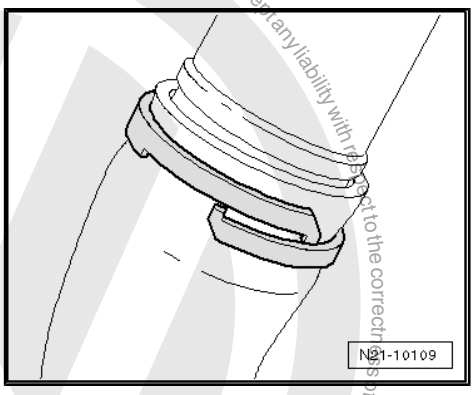
- Bring securing clip to release position -1-.
- Push charge air hose into coupling to stop.
- Set securing clip to locking position -2- and then push charge air hose again.
- Check if connector coupling seats correctly and is properly engaged by pulling hose.



4.1.2 Hoses with spring washer

Note

After charge air lines with spring-type clips have been removed and installed there is a danger of the "hose slipping" when driving. For this reason spring washers are installed that may only be opened if there is a defect in the charge air line. During repairs the spring washer must be destroyed using the appropriate tool and renewed with a part from ⇒ ETKA (Electronic Parts Catalogue) .



5 Removing and installing charge air cooler

5.1 Removing and installing charge air cooler

Removing ⇒ page 202

Installing ⇒ page 202

5.1.1 Removing

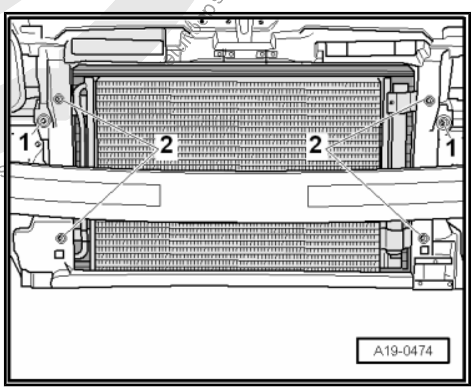
– Remove radiator ⇒ page 132 .

– Remove front bumper ⇒ General body repairs; Rep. Gr. 63 ; Front bumper

– Unscrew air guides on left and right side of charge air cooler.

> WARNING
>
> *The air conditioning system refrigerant circuit must not be opened.*

> Note
>
> *To prevent damage to condenser or to refrigerant lines and hoses, ensure that lines and hoses are not stretched, kinked or bent.*



– Remove securing bolts -2- from the condenser and fit to lock carrier.

– Remove bolts -1- on charge air cooler.

– Swivel the charge air cooler slightly back.

– Unhook charge air cooler upwards and take off downwards.

5.1.2 Installing

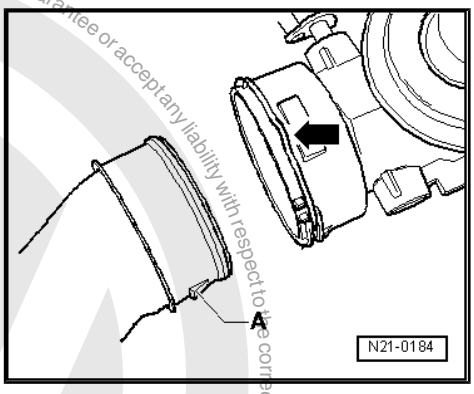
Install in reverse order. During this step, observe the following:

– Install front bumper ⇒ General body repairs; Rep. Gr. 63 ; Front bumper .

> Note
>
> *Renew seal.*

– When installing air duct pipes with connector, ensure that the retaining clip -arrow- engages audibly into the retaining lug -A-.

– Install cooler ⇒ page 132 .



Torque settings

Component	Nm
Charge air cooler to lock carrier	8
Condenser to charge air cooler	8

6 Checking charge air system for leaks

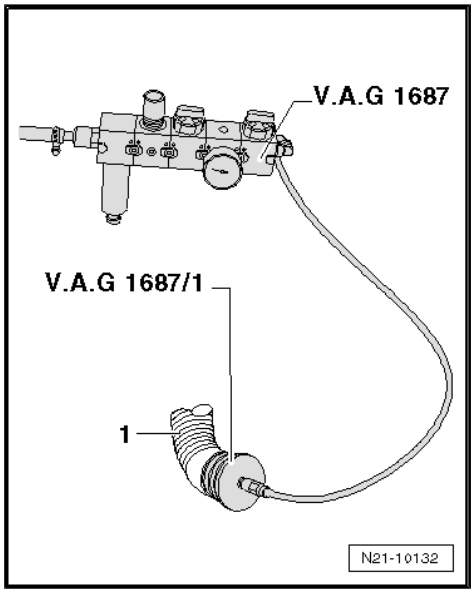
Special tools and workshop equipment required

- Charge air system tester -V.A.G 1687-
- Adapter -V.A.G 1687/1-

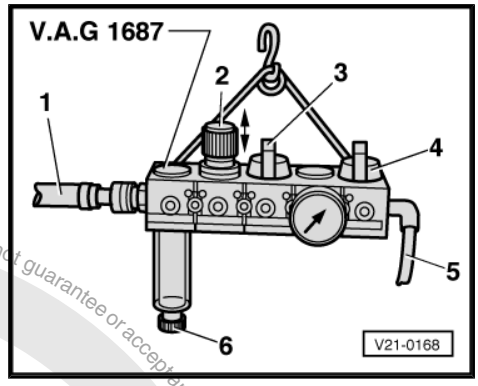
– Remove intake hose -1- from air filter.

– Connect adapter -V.A.G 1687/1- in intake hose -1- and secure with clip.

Prepare charge air system tester -V.A.G 1687- as follows:



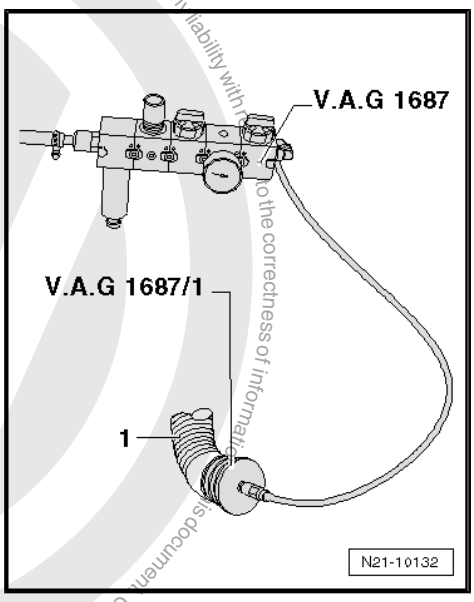
– Unscrew pressure regulating valve -2- complete and close valves -3- and -4-.



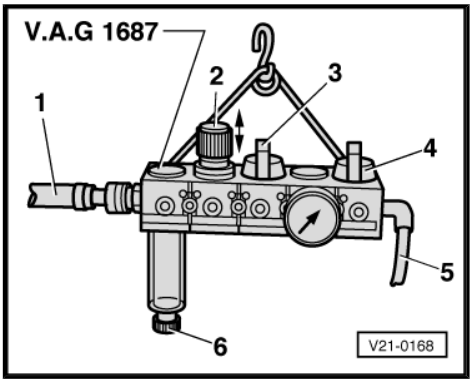
Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

– Connect charge air system tester -V.A.G 1687- to adapter -V.A.G 1687/1- as shown.



– Connect compressed air hose -1- (compressed air source) to charge air system tester -V.A.G 1687 - .



Note

If there is water in the sight glass, drain at water drain screw -6-.

– Open valve -3-.

– Adjust pressure to 0.5 bar with pressure regulating valve -2-.

Caution

The pressure must not exceed 0.5 bar! If the pressure is too high this can cause damage to the engine.

– Open valve -4- and wait until the test circuit is filled. If necessary readjust pressure to 0.5 bar.

– Check the charge air system for leaks by hearing, touching, with commercially available leak detector spray or using ultrasonic tester -V.A.G 1842- .

Note

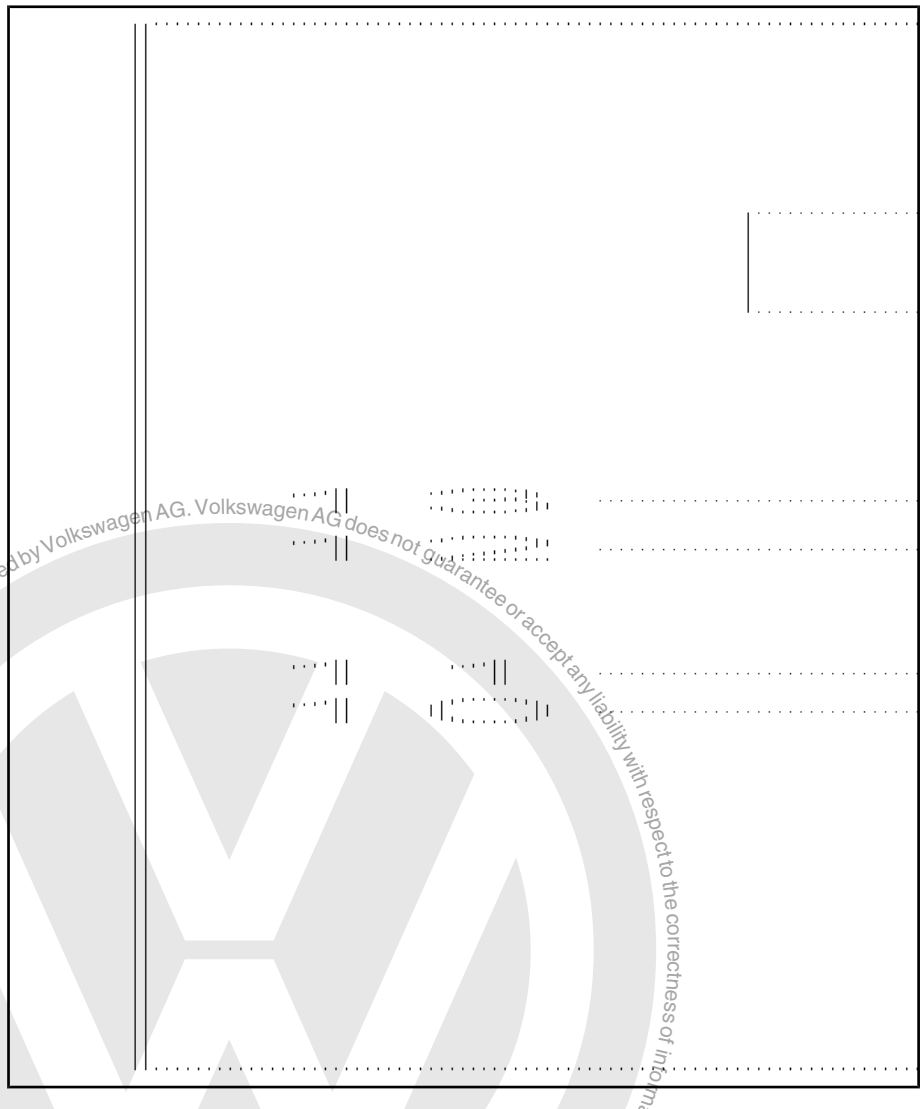
- *How to use the ultrasonic tester -V.A.G 1842 - ⇒ operating instructions*
- *If leaks occur, when doing any repair work observe notes for charge air system ⇒ page 183 .*
- *Before removing the adapter, depressurise the test circuit by pulling coupling off adapter -V.A.G 1687/1- .*

7 Vacuum hoses for connection diagram

Vehicles with engine codes BKC, BXE ⇒ page 206

Vehicles with engine codes BLS, BRM ⇒ page 207

7.1 Vehicles with engine codes BKC, BXE



1 - Solenoid valve block

2 - Non-return valve
- ❑ Note installation position.

3 - To brake servo

4 - Connecting pipe air filter/ turbocharger

5 - Air filter

6 - Intake manifold

7 - Cylinder head/cylinder block

8 - Vacuum reservoir

9 - Bypass flap
- ❑ For exhaust gas recirculation cooler.

10 - Radiator
- ❑ For exhaust gas recirculation.

11 - Exhaust gas recirculation valve -N18-

12 - Turbocharger

13 - Non-return valve
- ❑ Note installation position.

7.2 Vehicles with engine codes BLS, BRM

1 - Turbocharger

2 - Connecting pipe air filter/ turbocharger

3 - Non-return valve

- ❑ Note installation position.

4 - To brake servo

5 - Charge pressure control solenoid valve -N75 -

6 - Air filter

7 - Cylinder head/cylinder block

8 - Intake manifold

9 - Bypass flap

- ❑ For exhaust gas recirculation cooler.

10 - Radiator

- ❑ For exhaust gas recirculation.

11 - Exhaust gas recirculation valve -N18-

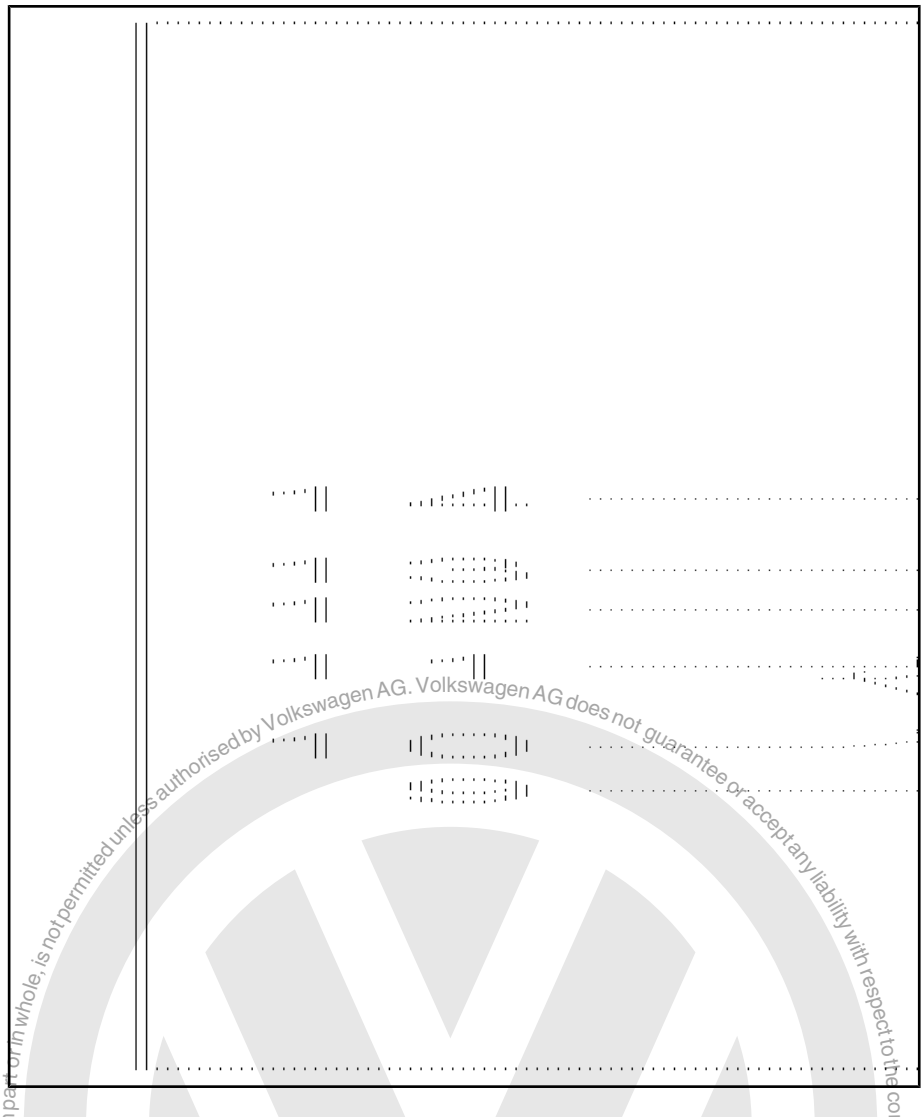
12 - Exhaust gas recirculation cooler change-over valve - N345-

13 - Non-return valve

- ❑ Note installation position.

14 - Non-return valve

- ❑ Note installation position.



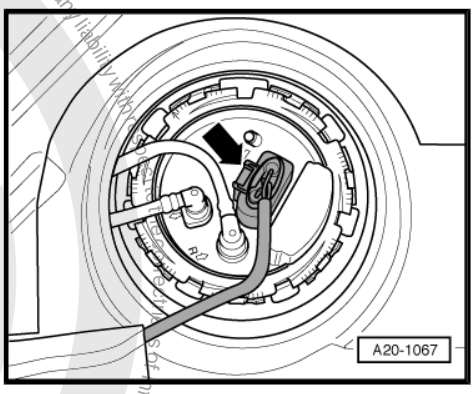
23 – Mixture preparation - injection

1 Diesel direct injection system

The diesel direct injection system control unit is equipped with a fault memory. Read fault memory before and after making repairs or adjustments.

1.1 Safety precautions

The fuel pump is activated when switching on the ignition and by the driver's door contact switch. For safety reasons, the connector -arrow- must be removed from the fuel delivery unit before opening the fuel system, if the battery is not disconnected.



Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings must be installed in the original way.*
- *Ensure that there is sufficient clearance to all moving or hot components.*

Observe following if test and measuring instruments are required during a road test:

WARNING

- *Test and measuring instruments must be secured to rear seat and operated by a second person from this location.*
- *If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.*

To prevent injuries to persons and/or damage to the injection and glow plug system, the following must be noted:

WARNING

- *The ignition must be switched off before connecting or disconnecting injection or glow plug system wiring or tester cables.*
- *If the engine is to be turned at starter speed, without starting, e.g. when checking compressions, disconnect unit injector connector on cylinder head.*
- *Before disconnecting battery, obtain radio code for radios fitted with anti-theft coding.*
- *Disconnecting and reconnecting the battery must only be undertaken when the ignition is switched off; otherwise the diesel direct injection system control unit may be damaged.*

1.2 Rules for cleanliness

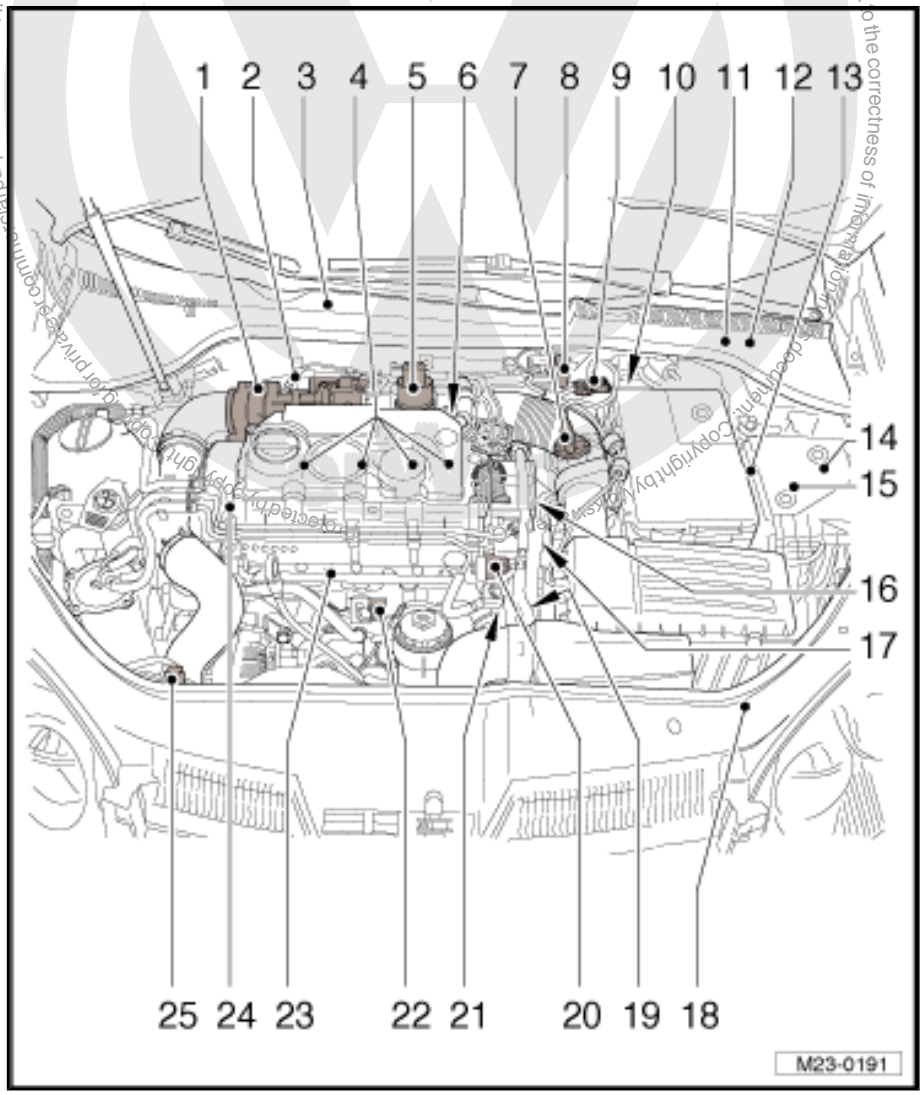
When working on fuel supply and injection system, pay careful attention to the following rules for cleanliness:

- Thoroughly clean all unions and adjacent areas before disconnecting.
- Place removed parts on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes, etc.).
- When system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.3 Fitting locations overview

Note

Some components are mounted under the engine cover.



1 - Intake manifold flap motor -V157-

- ❑ Removing and installing ⇒ page 235

2 - Exhaust gas recirculation potentiometer -G212- / exhaust gas recirculation valve -N18-

- ❑ Removing and installing ⇒ page 233

3 - Engine control unit

- ❑ Removing and installing ⇒ page 245

4 - Unit injectors

- ❑ Unit injector solenoid valve, No. 1 cyl. - N240-
- ❑ Unit injector solenoid valve, No. 2 cyl. - N241-
- ❑ Unit injector solenoid valve, No. 3 cyl. - N242-
- ❑ Unit injector solenoid valve, No. 4 cyl. - N243-
- ❑ Removing and installing unit injectors ⇒ page 219

5 - Turbocharger guide vane position sender -G500-

- ❑ Removing and installing ⇒ page 177

6 - Exhaust gas recirculation cooler change-over valve - N345-

- ❑ Location ⇒ page 213

7 - Air mass meter -G70-

- ❑ Removing and installing ⇒ page 237 .

8 - Charge pressure control solenoid valve -N75 -

- ❑ Location ⇒ page 213

9 - 6-pin connector

- ❑ For lambda probe -G39-
- ❑ Location ⇒ page 213

10 - Clutch position sender -G476-

- ❑ Location ⇒ page 216

11 - Clutch position sender -G79- / Clutch position sender 2 -G185-

- ❑ Location ⇒ page 216

12 - Brake light switch -F- and brake pedal switch -F47-

- ❑ Location ⇒ page 216

13 - Relay carrier

- ❑ Below electronics box engine compartment
- ❑ With automatic glow period control unit -J179-
- ❑ Location ⇒ page 217

14 - Fuel pump relay -J17-

- ❑ Location ⇒ page 217

15 - Relay and fuse holder in electronics box in engine compartment

- ❑ With terminal 30 voltage supply relay - J317-
- ❑ With terminal 15 voltage supply relay - J329-
- ❑ Location ⇒ page 217

16 - Tandem pump

- ❑ Checking ⇒ page 160
- ❑ Removing and installing ⇒ page 166

17 - Coolant temperature sender -G62-

- ❑ Location ⇒ page 214
- ❑ If necessary, release pressure in cooling system before removing

18 - Radiator outlet coolant temperature sender -G83-

- ❑ Fitting location, engine codes BKC, BXE ⇒ page 215
- ❑ Fitting location, engine codes BLS, BRM ⇒ page 215

19 - Fuel temperature sender -G81-

- ❑ Location ⇒ page 214

20 - Multi-pin connector

- ❑ For unit injectors
- ❑ Location ⇒ page 215

21 - Engine speed sender -G28-

- ❑ Location ⇒ page 214

22 - 3-pin connector

- ❑ For Hall sender -G40- .
- ❑ Location ⇒ page 214

23 - Glow plugs

- ❑ Glow plug 1 -Q10-
- ❑ Glow plug 2 -Q11-
- ❑ Glow plug 3 -Q12-
- ❑ Glow plug 4 -Q13-
- ❑ Removing, installing and testing ⇒ page 274

24 - Hall sender -G40-

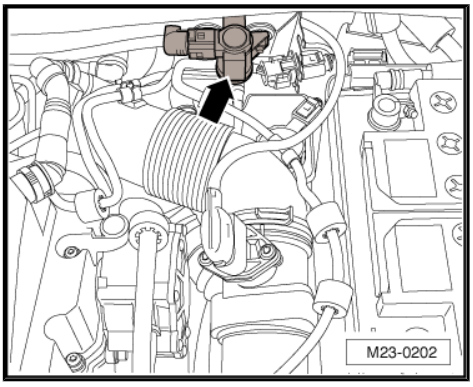
- ❑ For camshaft position
- ❑ Location ⇒ page 215

25 - Charge air pressure sender -G31- with intake air temperature sender -G42-

- ❑ Location ⇒ page 213

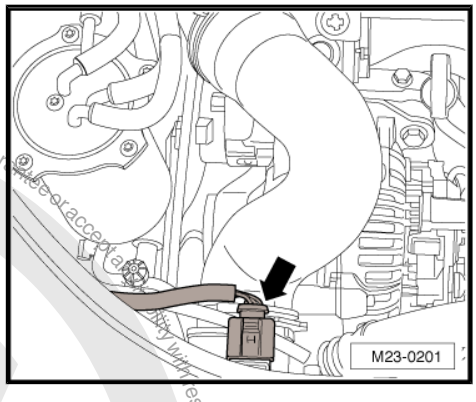
Fitting location: solenoid valve for charge pressure control -N75-

- On left bulkhead -arrow-.



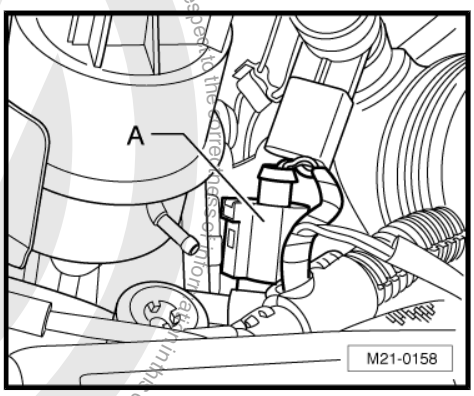
Fitting location: charge air pressure sender - G31- intake air temperature sender -G42-

- In air duct pipe behind the radiator -arrow-.



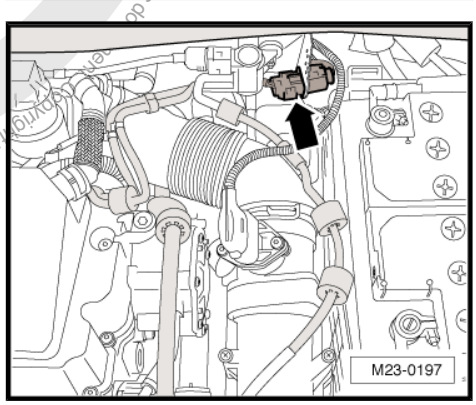
Fitting location: exhaust gas recirculation cooler change-over valve -N345-

- On rear left cylinder head.



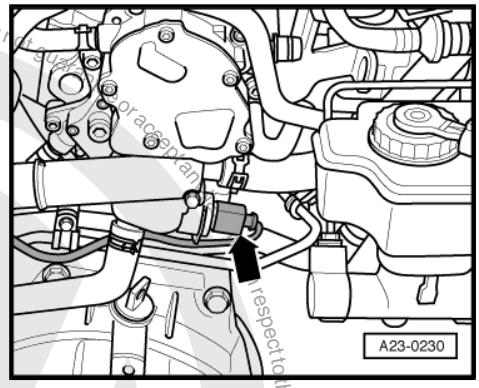
Fitting location: connector Lambda probe -G39-

- On left bulkhead -arrow-.



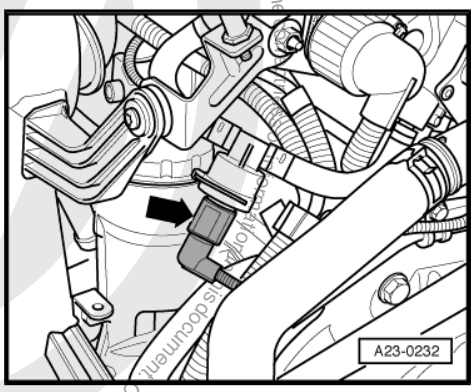
Fitting location: Coolant temperature -G62-

- On engine left.



Fitting location: Fuel temperature sender -G81-

- The sender -arrow- is fitted on engine front left.

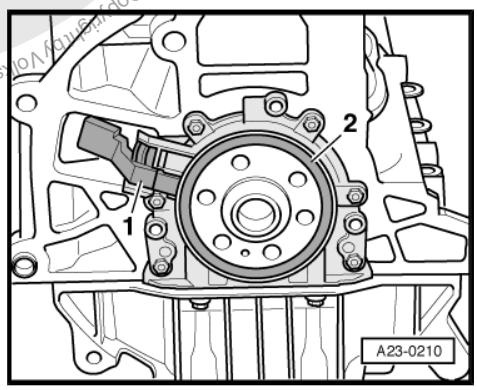


Fitting location: Engine speed sender -G28-

- On flywheel side of engine.

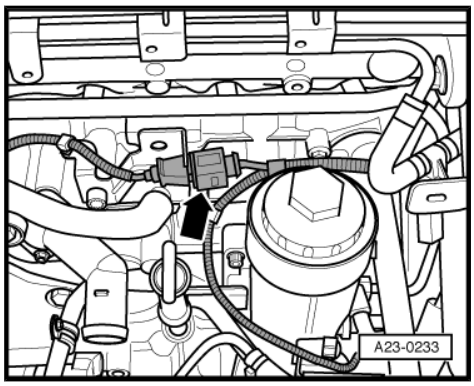
1 - Engine speed sender -G28-

2 - Sender wheel



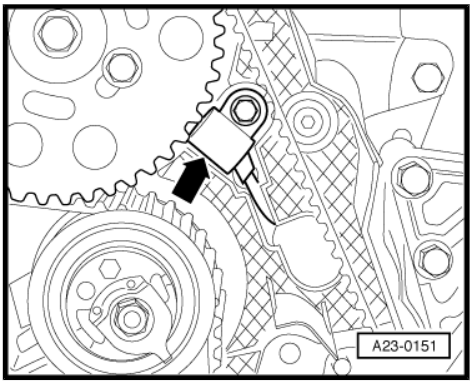
Fitting location of 3-pin connector for Hall sender -G40-

- Front on engine below intake manifold.



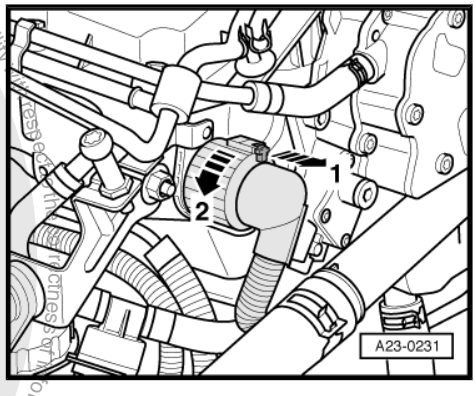
Fitting location: Hall sender -G40 -

- At camshaft sprocket on engine (right-side).



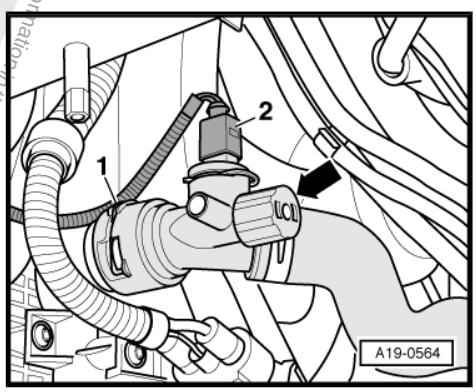
Fitting location of multi-pin connector for unit injectors

- To disconnect pull the release pin -arrow 1- and loosen knurled nut -arrow 2-.



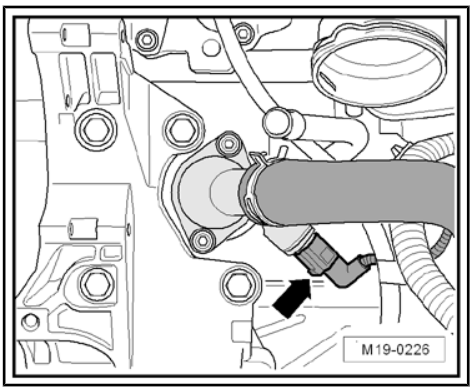
Fitting location of the radiator outlet coolant temperature sender -G83- , engine codes BKC, BXE

- The radiator outlet coolant temperature sender -G83- -item 2- is located above the drain plug -arrow- in the coolant hose -1- on the lower left of the radiator.

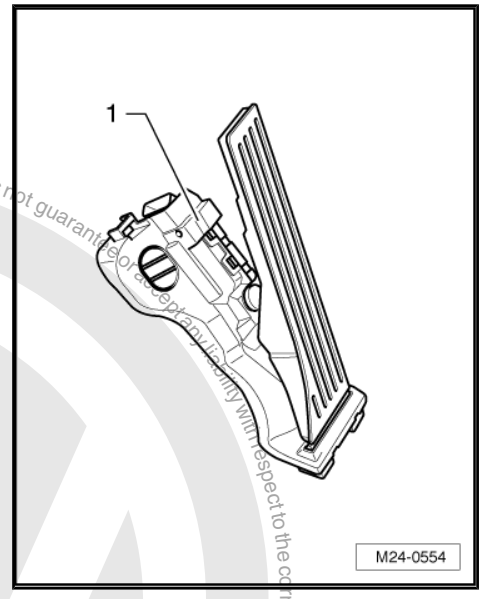


Fitting location of the radiator outlet coolant temperature sender -G83- , engine codes BLS, BRM

- The radiator outlet coolant temperature sender -G83- -arrow- is seated in the pipe union of the thermostat on front right on engine.



Fitting location: accelerator position sender -G79- with accelerator position sender 2 - G185- -1-

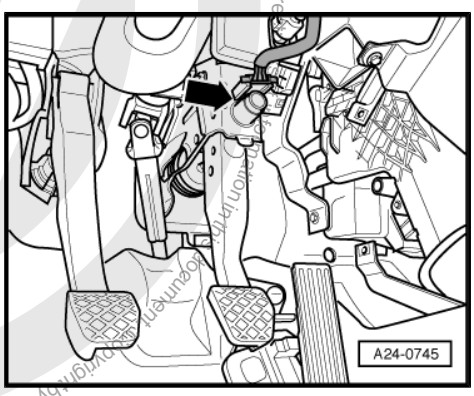


- In drive side footwell.
- Removing and installing ⇒ page 171 .

Note

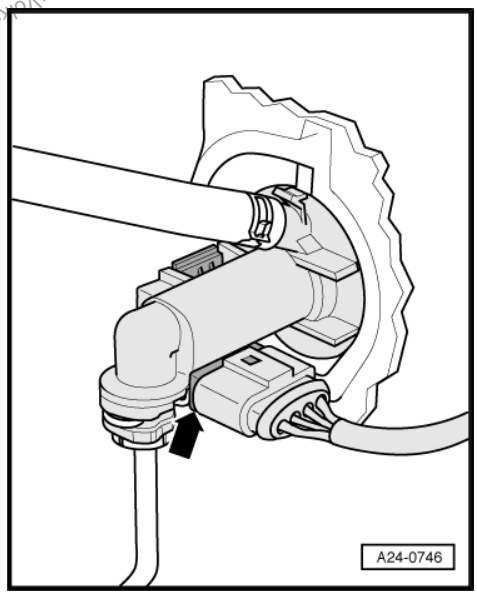
Diagram shows set-up on left drive vehicles.

Fitting location: brake light switch -F- and brake pedal switch -F47-



- Removing and installing ⇒ brake systems; Rep. Gr. 46 ; Remove, install and mount brake pedal - assembly overview; brake light switch -F- and brake pedal switch -F47- .

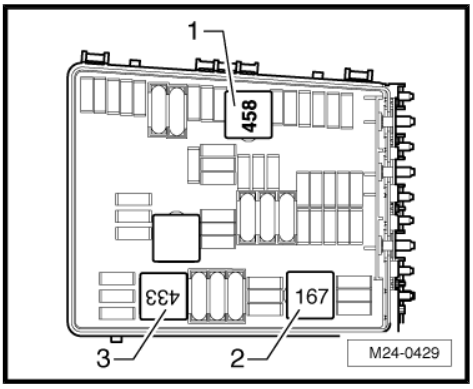
Fitting location: Clutch position sender -G476-



- Removing and installing ⇒ 5-speed manual gearbox 0A4; Rep. Gr. 30 .

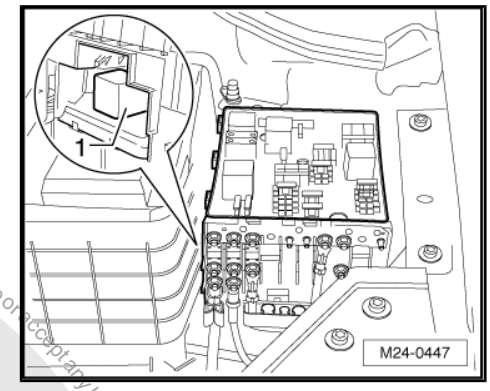
Fitting location of relay and fuse holder in electronics box in engine compartment

- Terminal 30 voltage supply relay -J317 - -1-.
- Terminal 15 voltage supply relay -J329 - -3-.



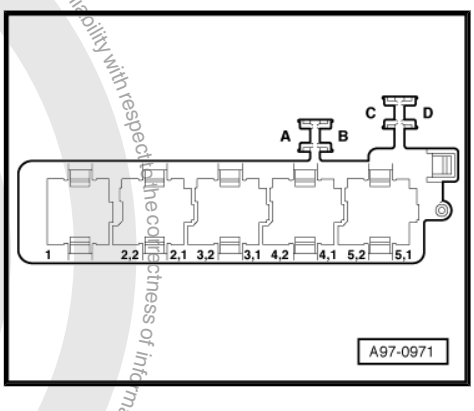
Fitting location: Automatic glow period control unit -J179-

- Electronics box engine compartment -1-.



Fitting location: Fuel pump relay -J17-

- Plug position -2.1- in 5-pin relay carrier via the onboard supply control unit, below dash panel on driver side.



1.4 Assembly overview - unit injector

- Observe rules for cleanliness ⇒ page 210 .
- Always renew seals and O-rings

1 - 20 Nm + 90° (1/4 turn) further

- ❑ Renew.

2 - Rocker arm shaft

- ❑ With rocker arms
- ❑ Removing and installing ⇒ page 219 .

3 - Lock nut, 30 Nm

4 - Adjuster screw

- ❑ Renew.

5 - Ball stud

- ❑ Renew.

6 - Unit injector

- ❑ Removing and installing ⇒ page 219 .

7 - O-ring

- ❑ Renewing ⇒ page 222 .

8 - O-ring

- ❑ Renewing ⇒ page 222 .

9 - O-ring

- ❑ Renewing ⇒ page 222 .

10 - Heat shield seal

- ❑ Renew.

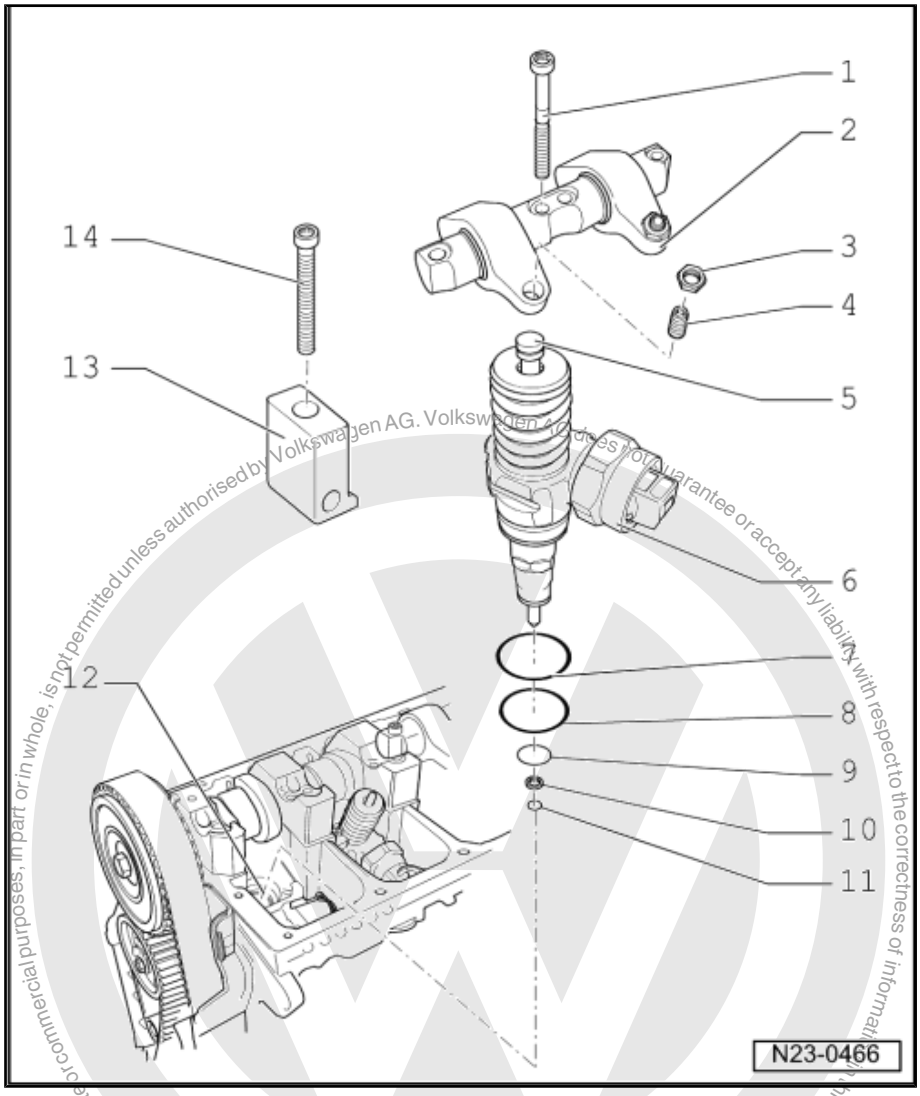
11 - Circlip

12 - Cylinder head

13 - Clamping block

14 - 12 Nm +270° (3/4 turn) further

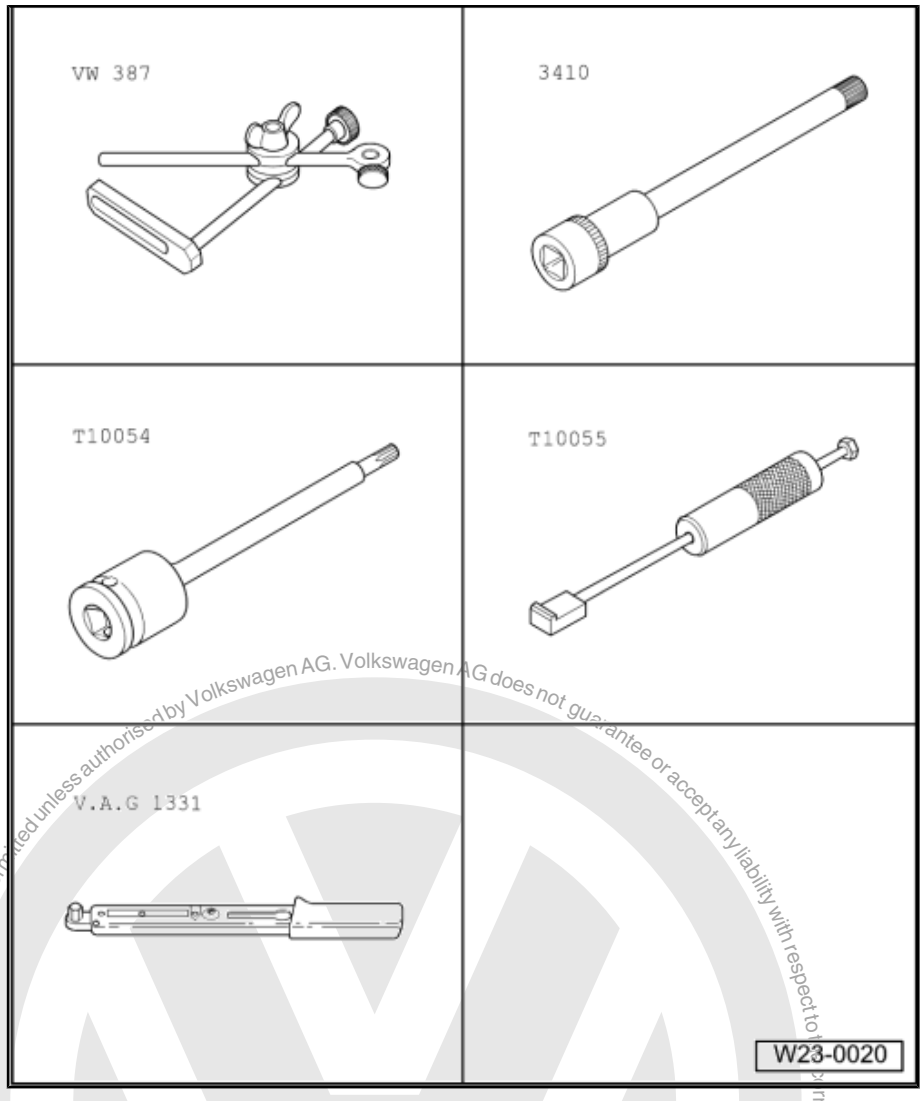
- ❑ Renew.



1.5 Removing and installing unit injector

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-
- Special wrench, long reach -3410-
- Special wrench, long reach -T10054-
- Puller -T10055-
- Torque wrench - V.A.G 1331-



Removing ⇒ page 219

Installing ⇒ page 220

1.5.1 Removing

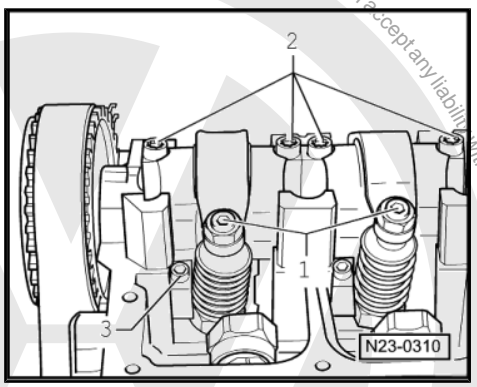
– Remove upper toothed belt guard.

– Remove cylinder head cover ⇒ page 61 .

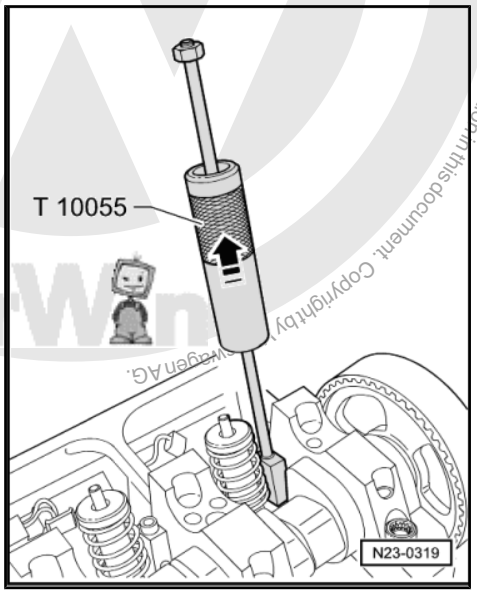
– Turn crankshaft until the cam pair for the unit injector which is to be removed point uniformly upwards.

– Loosen adjustment screw lock nuts -1- and remove adjustment screws.
– Remove rocker arm securing bolts -2- (from outwards to inwards) with socket -3410- and take rocker arm shaft off.
– Loosen tensioning block securing bolt -3- using special wrench, long reach -T10054- and remove tensioning block.
– Lever connector off unit injector with a screwdriver. To avoid canting, support opposite side of connector with light finger pressure.

Observe unit injector cylinder allocation.



– Insert puller -T10055- in place of the clamping block in the slot on the side of the unit injector.
– Pull the unit injector off by knocking it outwards the cylinder head seat.



1.5.2 Installing

Note

- *Each time work is performed which requires adjustment of the unit injector, the adjustment screw in the rocker arm and also the unit injector ball stud must be renewed.*
- *New unit injectors are supplied with O-rings and insulating seals.*

– Heat insulating seal and O-rings must be renewed if old unit injector is reused ⇒ page 222 .
– Check that the three O-rings and the heat insulating seal along with circlip are seated correctly before installing unit injector.

Note

The seals must not be twisted.

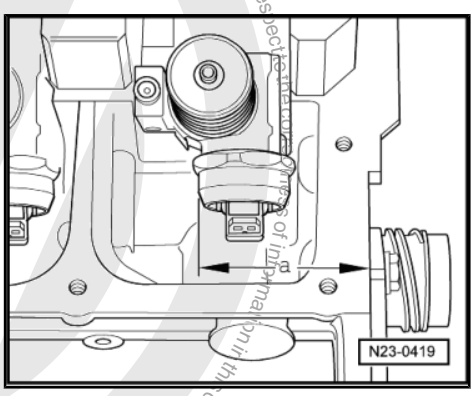
– Oil seals and insert the injector unit with greatest care in the cylinder head seat.
– Push the injector unit evenly into the cylinder head onto its stop.
– Insert the clamping block in the slot on the side of the unit injector.

Note

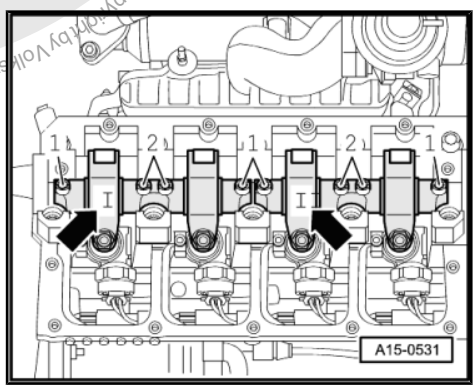
If the unit injector is not at right angles to the tensioning block the securing bolt may loosen and this can damage the unit injector or the cylinder head.

– Therefore align the unit injector as follows.
– Screw the new securing bolt into the tensioning block only so far that the unit injector can still be turned easily.
– Now align unit injector at right angles to camshaft mounting brackets.
– Check dimension -a- from outer edge of cylinder head to rounded edge of unit injector using a vernier gauge (measuring range of at least 400 mm).

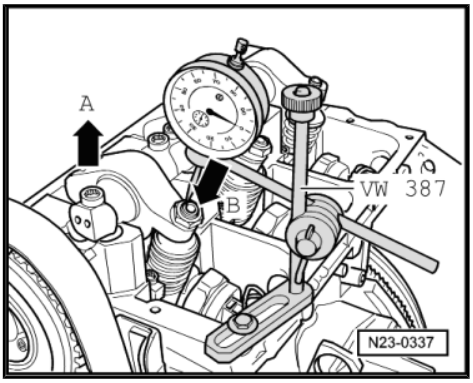
Cylinder	Dimension “a”
1	333.0 ± 0.8 mm
2	245.0 ± 0.8 mm
3	153.6 ± 0.8 mm
4	65.6 ± 0.8 mm



– Align unit injector and tighten securing bolt as follows: 12 Nm and 270° ($^3/_4$ turn) further. Turning further can be done in several stages.
– Fit rocker arm shaft and tighten new securing bolts as follows:
– First evenly tighten inner bolts -2- and then outer bolts -1- hand-tight. Then tighten to 20 Nm and turn 90° ($^1/_4$ turn) further evenly in the same sequence.



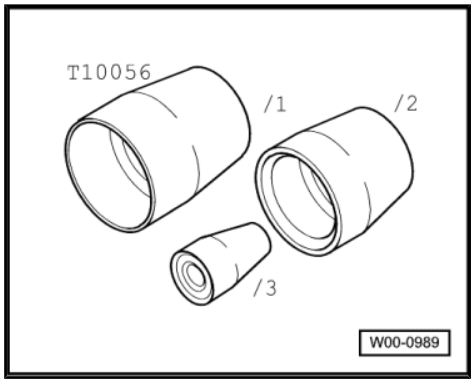
– Fit the dial gauge onto the adjustment screw of the unit injector as shown.
– Turn the crankshaft in engine direction of rotation until the roller of the rocker arm is positioned on the peak of the drive cam. Roller side -arrow A- positioned at highest point on dial gauge -arrow B- positioned at lowest point.
– Remove dial gauge.
– Now turn the adjuster screw into rocker arm until significant resistance can be felt (unit injector is at limit stop).
– Turn adjuster screw 180° back from stop.
– Hold adjuster screw in this position and tighten lock nut to 30 Nm.
– Connect unit injector connector.
– Install cylinder head cover ⇒ page 61 .
– Install toothed belt guard.



1.6 Removing and installing unit injector O-rings

Special tools and workshop equipment required

- Assembly sleeves -T10056-



Removing ⇒ page 222

Installing ⇒ page 222

1.6.1 Removing

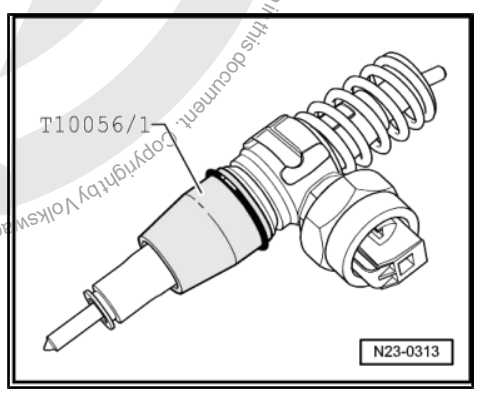
– Remove unit injector ⇒ page 219 .
– Lever old O-rings very carefully out of unit injector.
– Above all ensure that burrs are not caused on O-ring seating.

1.6.2 Installing

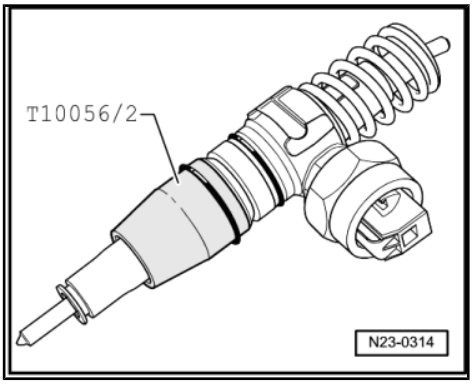
Note

- *Always use the assembly sleeves to fit the O-rings. There is a danger of damaging the O-rings if the sleeves are not used.*
- *Gradual introduction of O-rings without different coloured markings. Note the correct allocation of O-rings to grooves: the thickness of the rings reduces towards injector nozzle.*
- *Avoid rolling when sliding onto the O-rings. The O-rings must not be twisted in their seats in unit injector.*

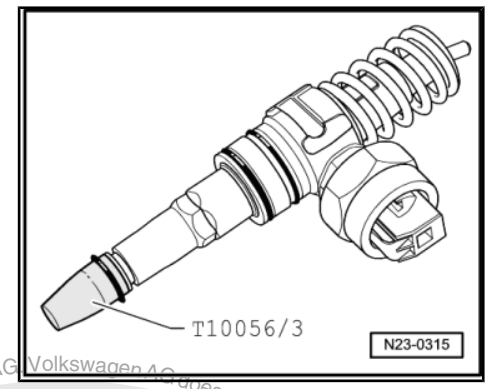
– Remove the insulating seal together with the retaining ring.
– Clean seating surfaces for O-rings on unit injector very carefully.
– Fit assembly sleeve -T10056/1- onto unit injector, pushing it to the limit stop.
– Push the upper, thicker O-ring carefully onto the assembly sleeve and into the seat on the unit injector.
– Remove the assembly sleeve.



– Fit assembly sleeve -T10056/2- onto unit injector, pushing it to the limit stop.
– Slide the middle, thinner O-ring carefully onto assembly sleeve and into seat on unit injector.
– Remove the assembly sleeve.



– Fit assembly sleeve -T10056/3- onto unit injector, pushing it to the limit stop.
– Push the lower O-ring carefully onto the assembly sleeve and into the seat of the unit injector.
– Remove the assembly sleeve.
– Push on a new insulating seal together with the retaining ring.



1.7 Assembly overview - intake manifold

Intake manifold - Assembly overview, engine codes BKC, BXE
⇒ page 224

Intake manifold - Assembly overview, engine codes BLS, BRM
⇒ page 225

1.7.1 Intake manifold - Assembly overview, engine codes BKC, BXE

1 - Intake manifold
- ❑ Tighten securing bolts to 22 Nm.

2 - O-ring
- ❑ Renew.

3 - Intake connecting pipe
- ❑ With exhaust gas recirculation valve.

4 - 10 Nm

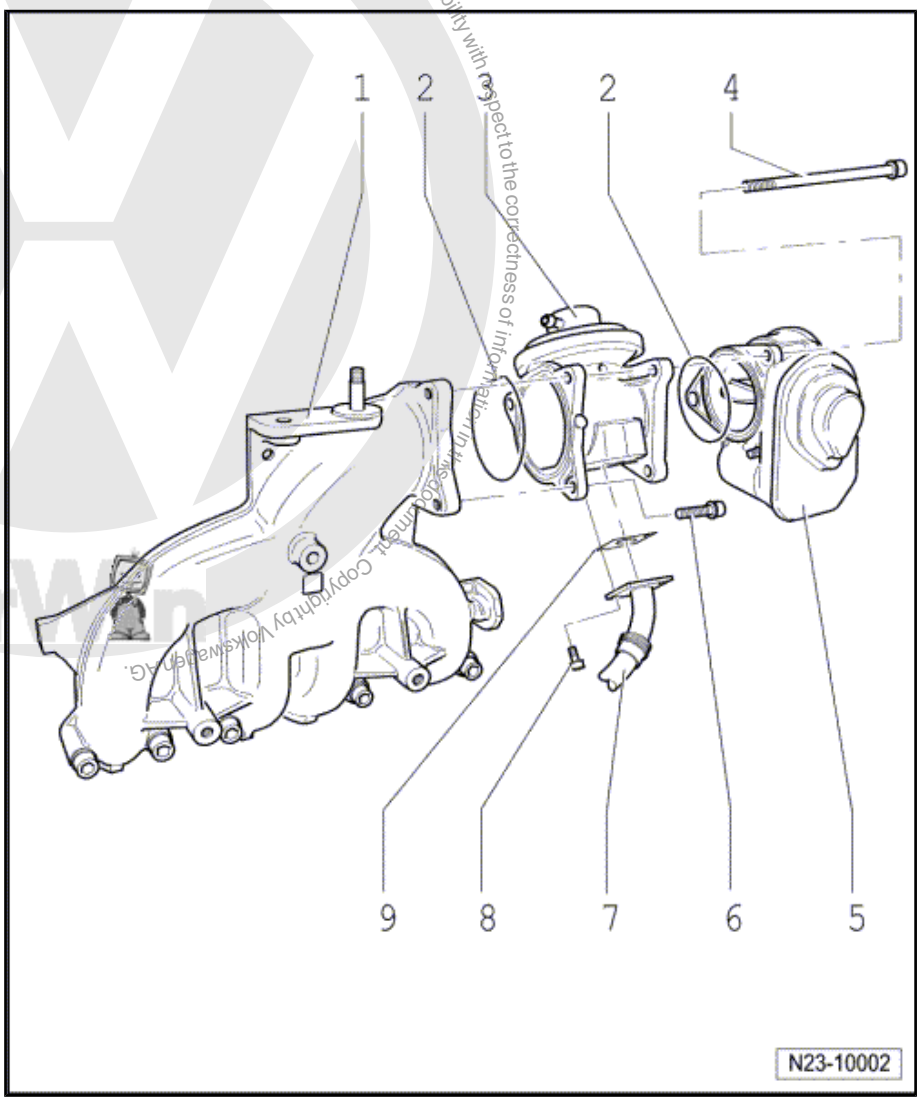
5 - Intake manifold flap motor - V157-
- ❑ The intake manifold flap is closed for approx. 3 seconds when the engine stands and then opens again. When doing this the stop stroke is reduced.

6 - 10 Nm

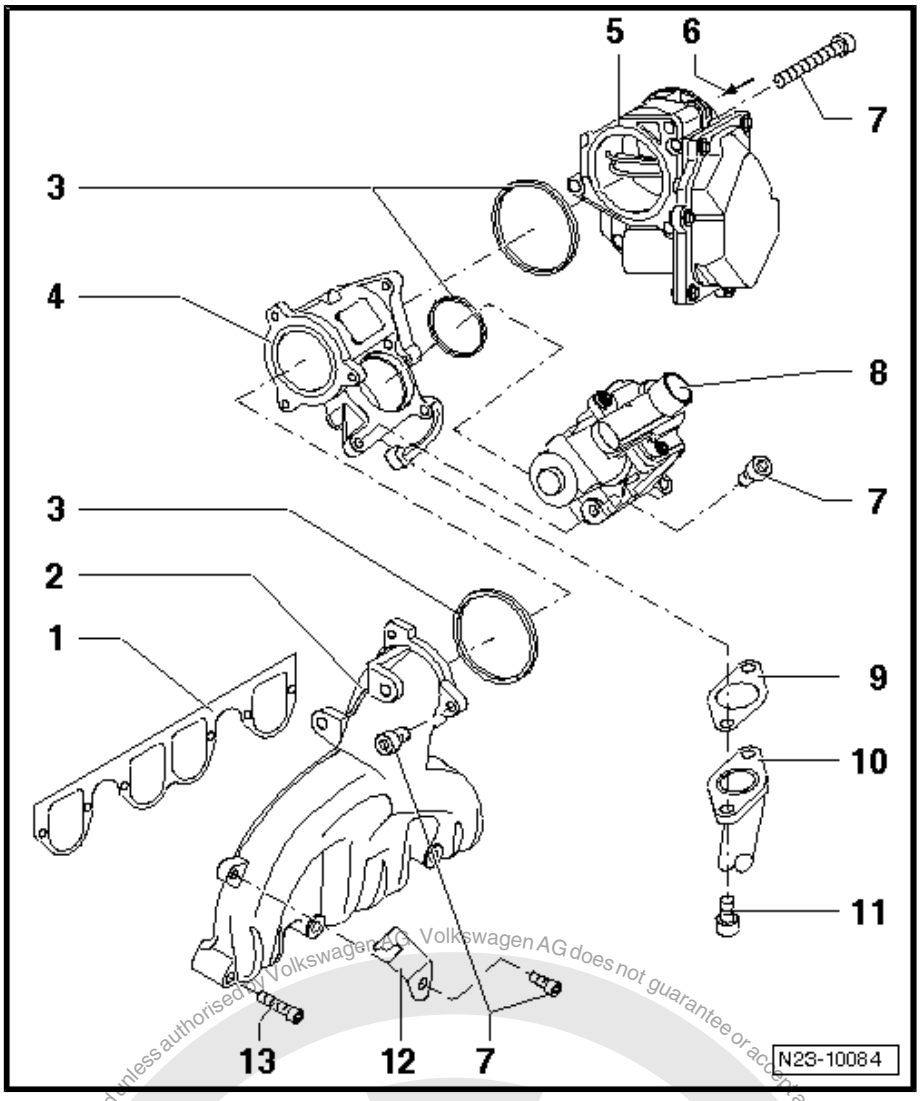
7 - Connecting pipe
- ❑ To exhaust gas recirculation cooler.

8 - 22 Nm

9 - Seal
- ❑ Renew.



1.7.2 Intake manifold - Assembly overview, engine codes BLS, BRM



1 - Seal

- ❑ replace

2 - Intake manifold

- ❑ Tighten securing bolts to 22 Nm

3 - Oil seal

- ❑ Renew.

4 - Intake connecting pipe

5 - Intake manifold flap motor -V157-

- ❑ The intake manifold flap is closed for approx. 3 seconds when the engine stands and then opens again. When doing this the stop stroke is reduced.

6 - From charge air cooler

7 - 10 Nm

8 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

- ❑ Assembly overview - exhaust gas recirculation ⇒ page 263

9 - Seal

- ❑ Renew.

10 - Connecting pipe

- ❑ To exhaust gas recirculation cooler.
- ❑ Assembly overview - parts for exhaust gas recirculation ⇒ page 262

11 - 22 Nm

12 - Retainer

- ❑ For connector

13 - 22 Nm

1.8 Removing and installing intake manifold

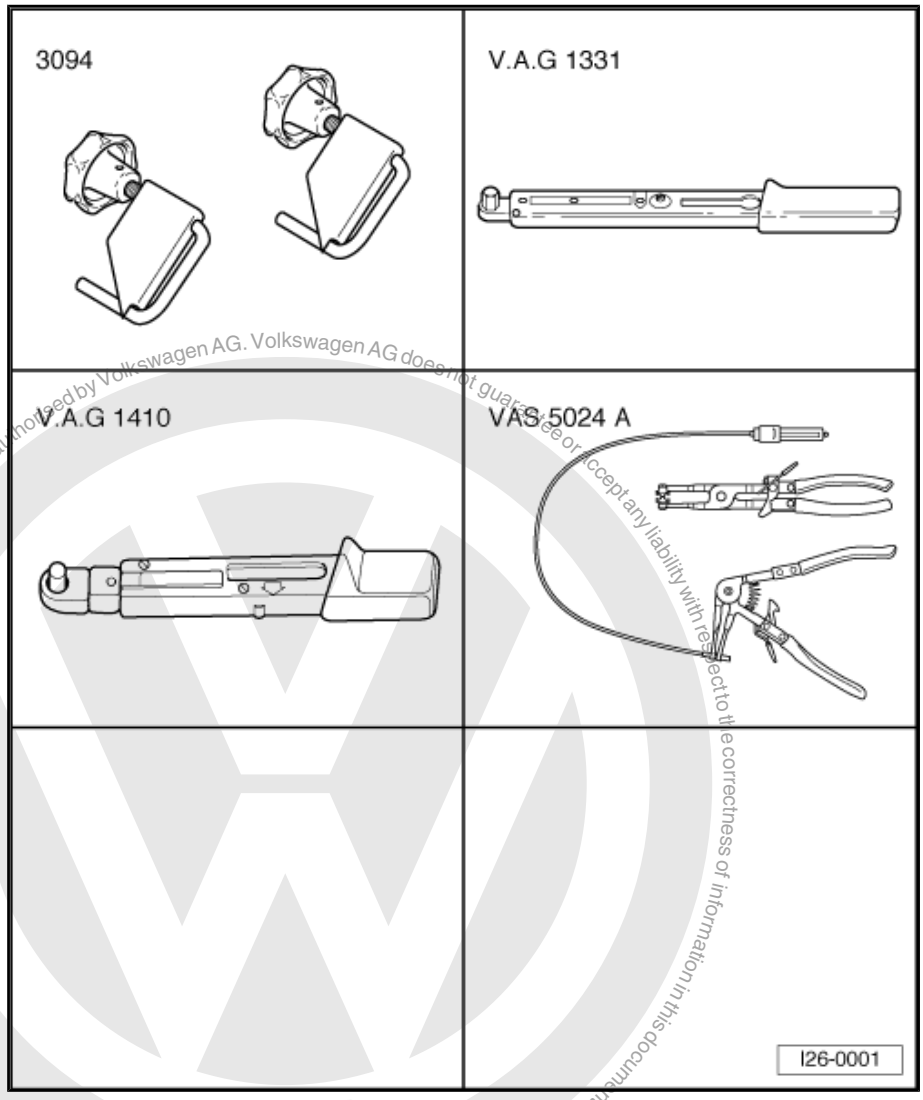
Removing and installing intake manifold, engine codes BKC, BXE
⇒ page 226

Removing and installing intake manifold, engine codes BLS, BRM
⇒ page 231

1.8.1 Removing and installing intake manifold, engine codes BKC, BXE

Special tools and workshop equipment required

- Hose clamps to Ø 25 mm -3094-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1410-
- Spring-type clip pliers -VAS 5024A-

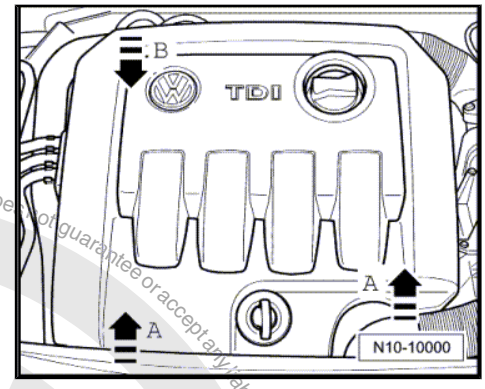


Removing ⇒ page 227

Installing ⇒ page 230

Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

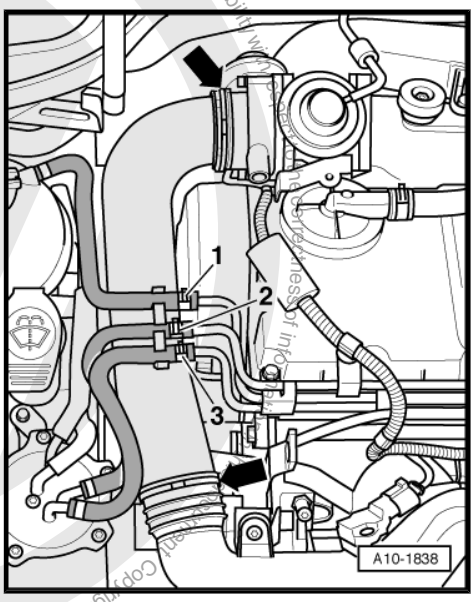


Note

The hoses -2- remain connected.

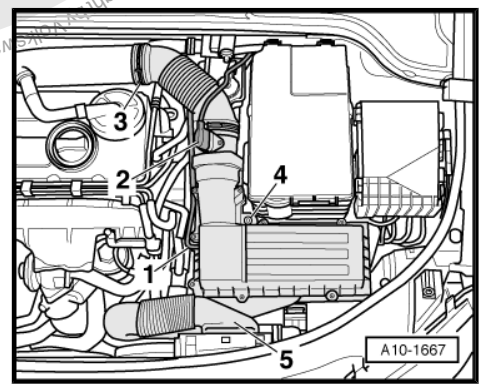
– Place lines -2- on air duct pipe to side.

– Remove air pipe. To do this lift retaining clips -1- lightly.



– Disconnect connector -2- on air mass meter -G70- .

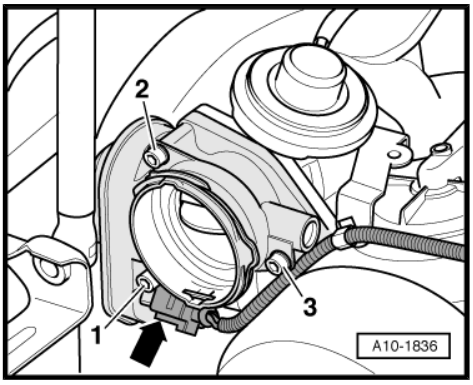
– Pull breather hose -1- and air duct hose -3- off.



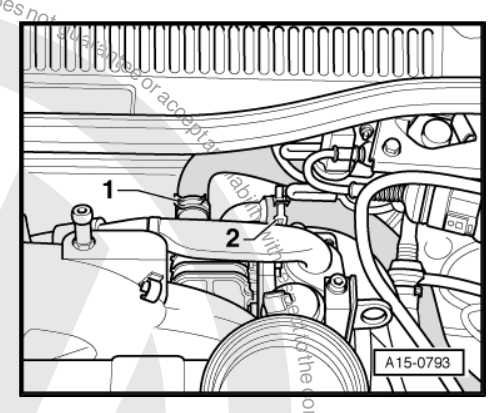
– Disconnect connector -arrow- on intake manifold flap motor -V157- .

– Remove bolts -1 … 3- and take intake manifold flap motor -V157- off.

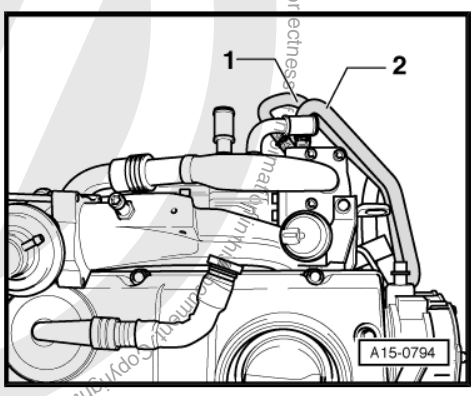
– Remove intake pipe with exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18- ⇒ page 233 .



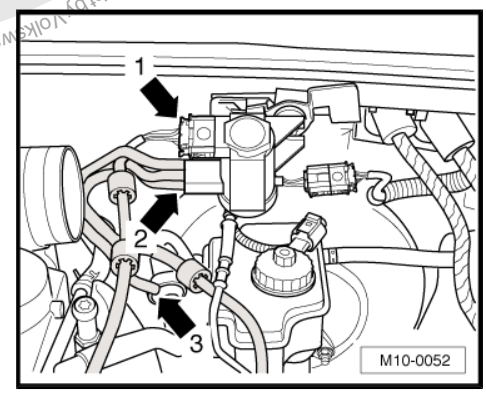
– Pull off or disconnect coolant hoses -1- and -2- on exhaust gas recirculation cooler using hose clamps to Ø 25 mm -3094- .



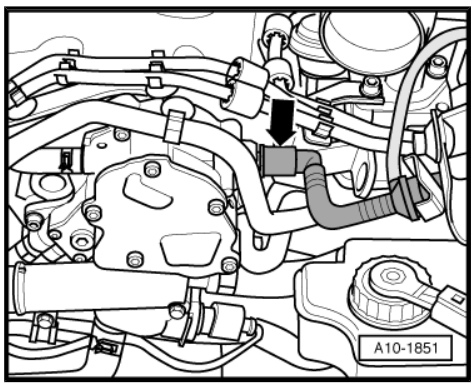
– Pull off or disconnect coolant hoses -1- and -2- using hose clamps to Ø 25 mm -3094- .



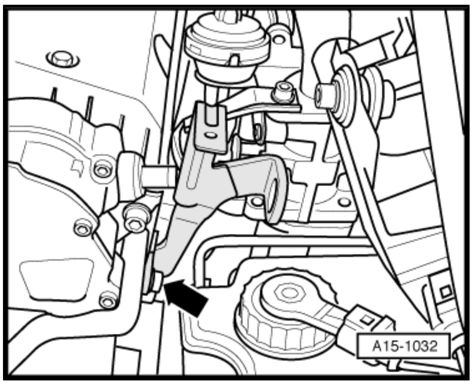
– Pull vacuum hoses -arrow 2- off.
– Pull vacuum hose -arrow 3- off non-return valve for brake servo.



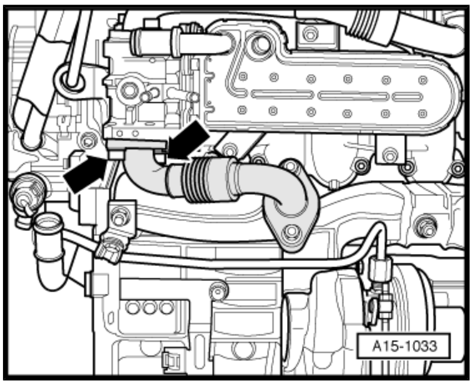
– Pull vacuum hose -arrow- to brake servo off tandem pump.



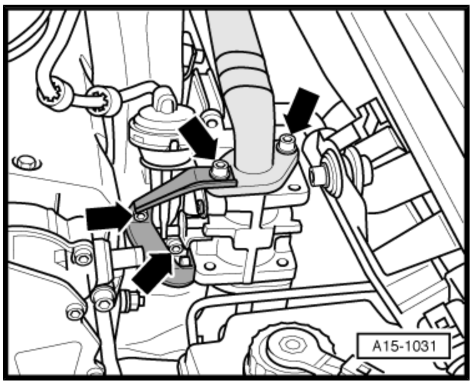
– Remove engine lifting eye on rear of cylinder head -arrow-.



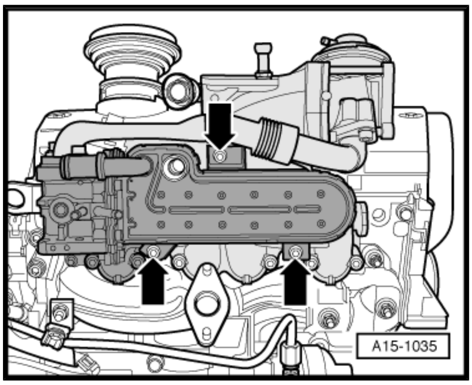
– Remove lower connecting pipe on change-over flap for exhaust gas recirculation -arrows-.



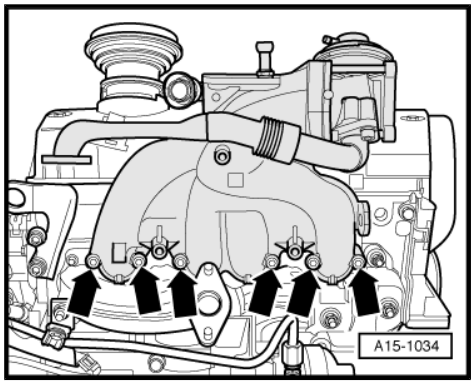
– Unscrew bolts -arrows-.



– Remove exhaust gas recirculation cooler and change-over flap from intake manifold -arrows- and take out.



– Unbolt intake manifold -arrows-.



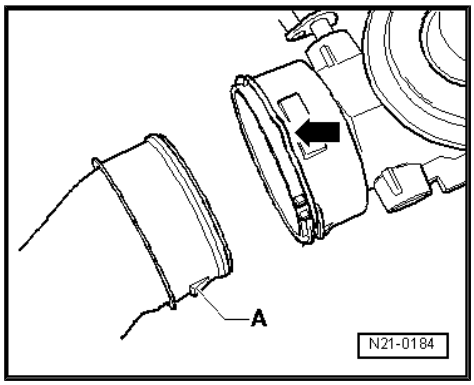
Installing

Install in reverse order. In the process, note the following:

Note

- *Renew gaskets and seals.*
- *Observe installation position of seal for intake manifold.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.



– Fill with coolant ⇒ page 127 .

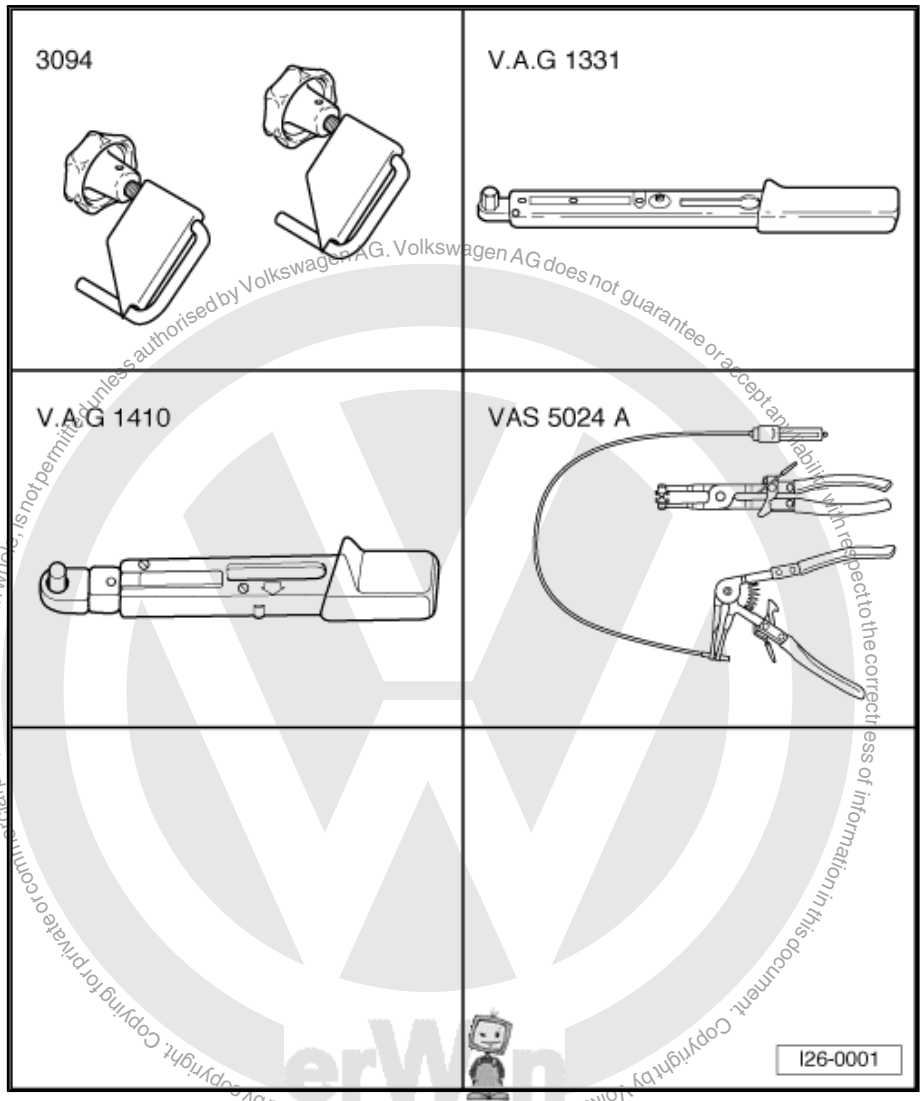
Torque settings

Component	Nm
Intake manifold to cylinder head	22
Engine lifting eye on cylinder head	22
Retainer to intake manifold	10
Connecting pipe for exhaust gas recirculation to change-over flap	22
Exhaust gas recirculation cooler to intake manifold	10
Intake manifold flap motor -V157- to intake manifold	10

1.8.2 Removing and installing intake manifold, engine codes BLS, BRM

Special tools and workshop equipment required

- Hose clamps to Ø 25 mm -3094-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1410-
- Spring-type clip pliers -VAS 5024A-

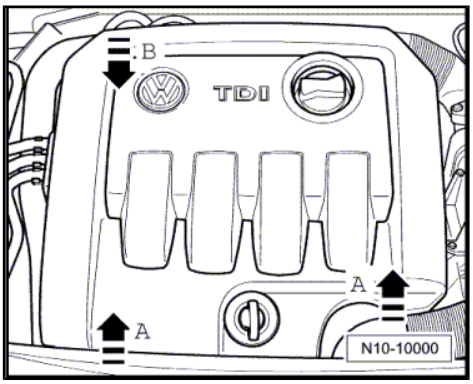


Removing ⇒ page 231

Installing ⇒ page 232

Removing

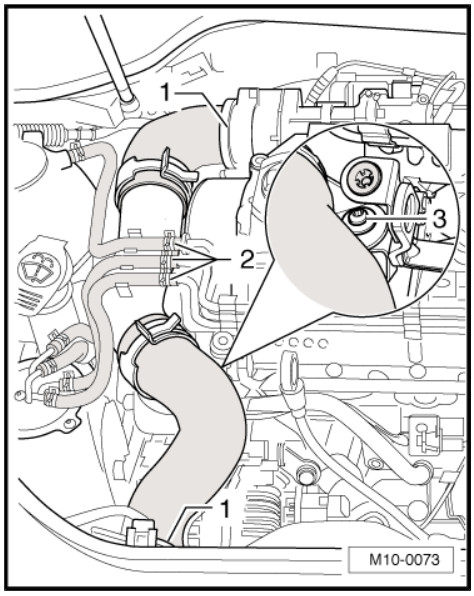
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



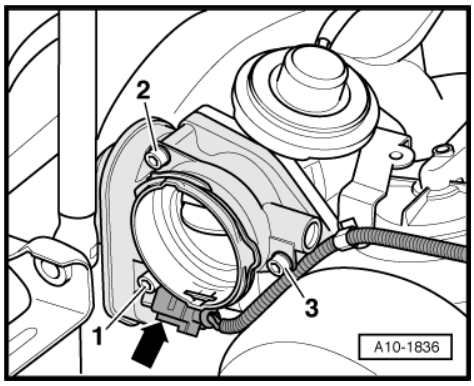
Note

The hoses -2- remain connected.

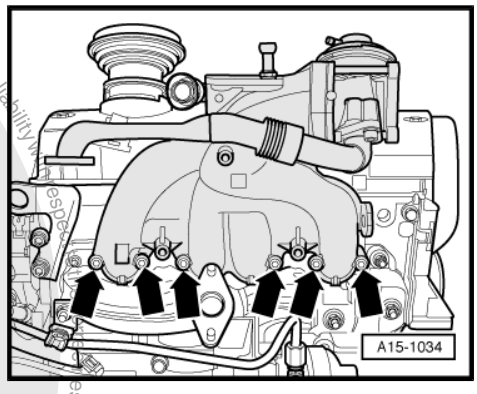
– Remove air pipe. To do this lift retaining clips -1- slightly and remove the bolt -3- from the transport bracket.



– Disconnect connector -arrow- on intake manifold flap motor -V157- .
– Remove bolts -1 … 3- and take intake manifold flap motor -V157- off.
– Remove intake pipe with exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18- ⇒ page 233 .
– Remove turbocharger ⇒ page 188 .



– Unbolt intake manifold -arrows-.



Installing

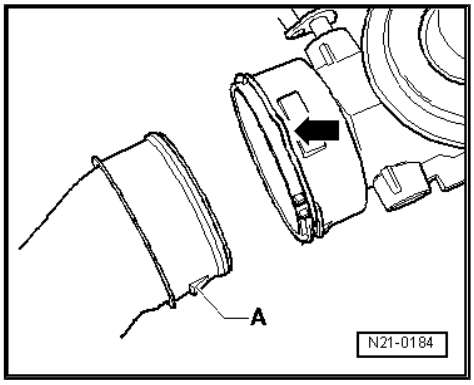
Install in reverse order. In the process, note the following:

Note

- *Renew gaskets and seals.*
- *Observe installation position of seal for intake manifold.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.

– Fill with coolant ⇒ page 127 .



Torque settings

Component	Nm
Intake manifold to cylinder head	22
Engine lifting eye on cylinder head	22
Retainer to intake manifold	10
Connecting pipe for exhaust gas recirculation to change-over flap	22
Exhaust gas recirculation cooler to intake manifold	10
Intake manifold flap motor -V157- to intake manifold	10

1.9 Removing and installing intake pipe with exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18- , engine codes BLS, BRM

Removing ⇒ page 233

Installing ⇒ page 233

1.9.1 Removing

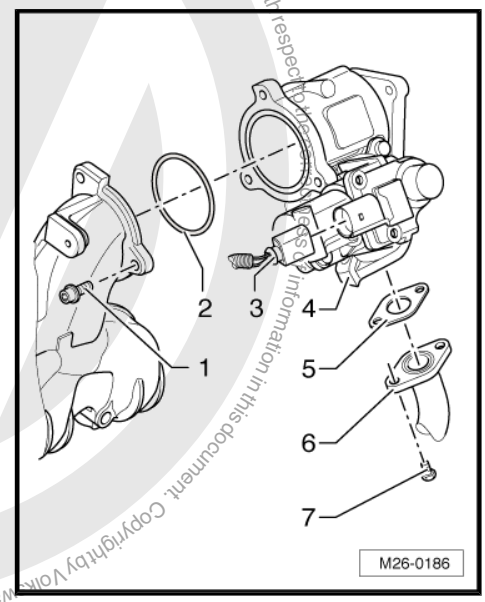
– Remove intake manifold flap motor - V157- ⇒ page 235 .

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Loosen connecting pipe -6- from intake pipe -4-. Remove bolts -7- for this.

– Release connector -3- from intake pipe -4- and pull off.

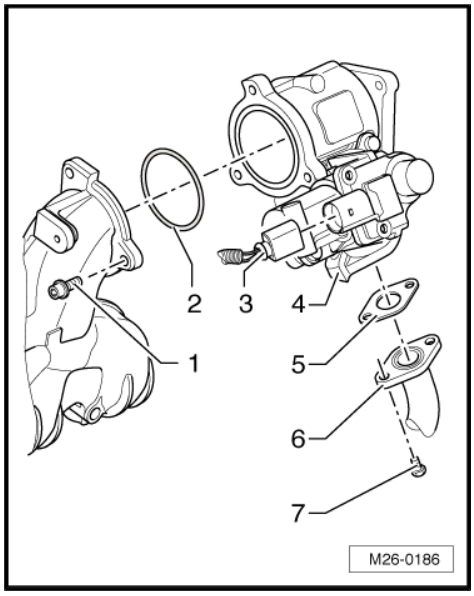
– Unscrew bolts -1- and take intake pipe -4- off.



1.9.2 Installing

Install in reverse order. In the process, note the following:

– Renew sealing ring -2- and seal -5-.
– Tighten bolts -1- and -6- to 10 Nm.
– Install intake manifold flap motor - V157- ⇒ page 235 .



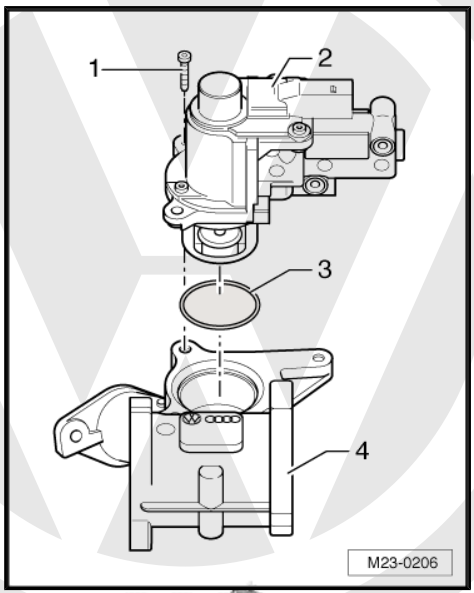
1.10 Dismantling and assembling intake pipe with with exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18- , engine codes BLS, BRM

Special tools and workshop equipment required

♦ Wet and dry cleaner -VAS 5128-
♦ Plastic brush

Dismantling

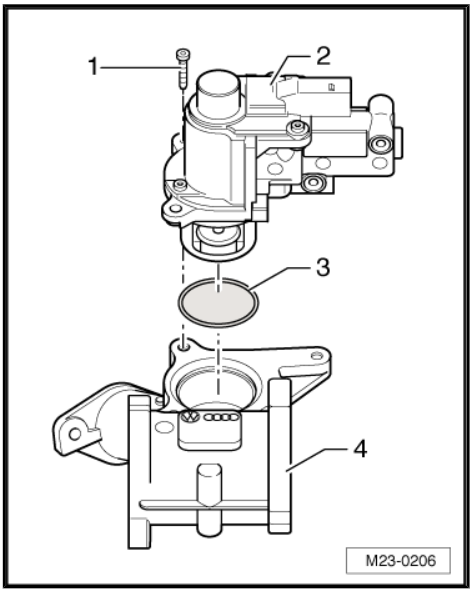
– Remove intake pipe with exhaust gas recirculation potentiometer -G212- with exhaust gas recirculation valve -N18- ⇒ page 233 .
– Remove bolts -1- and carefully pull exhaust gas recirculation potentiometer -G212- with exhaust gas recirculation valve -N18- -2- off the intake pipe -4-
– Clean exhaust gas recirculation valve sooted surfaces with a plastic brush . Afterwards remove loose soot with a cloth.
– For protection against soot particles cover intake manifold inner part with a lint-free cloth.
– Clean exhaust gas recirculation valve seat in intake manifold with a plastic brush and a cloth. Ensure that no soot particles enter the intake manifold.
– Take the cloth out of the intake manifold and clean the intake manifold with a wet and dry cleaner -VAS 5128- , if necessary.



Assembling

– Renew the O-ring -3-.

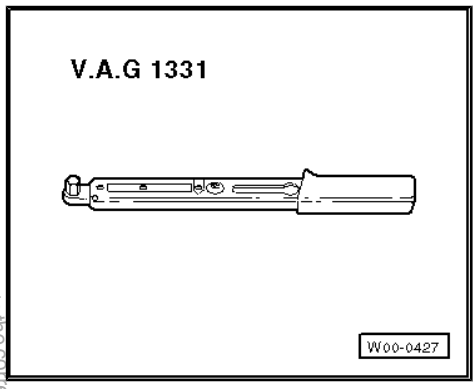
– Carefully fit the exhaust gas recirculation potentiometer - G212- with the exhaust gas recirculation valve -N18- -2- into the seat of the intake pipe -4- and tighten the bolts -1- to 10 Nm.



1.11 Removing and installing intake manifold flap motor -V157-

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1331-

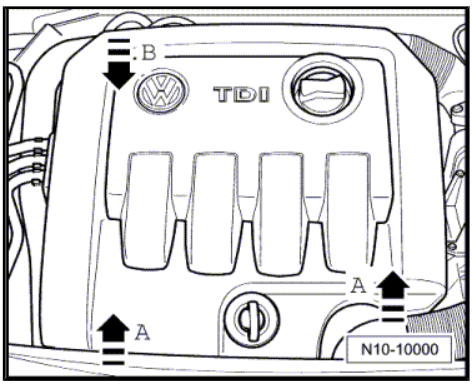


Removing ⇒ page 235

Installing ⇒ page 236

1.11.1 Removing

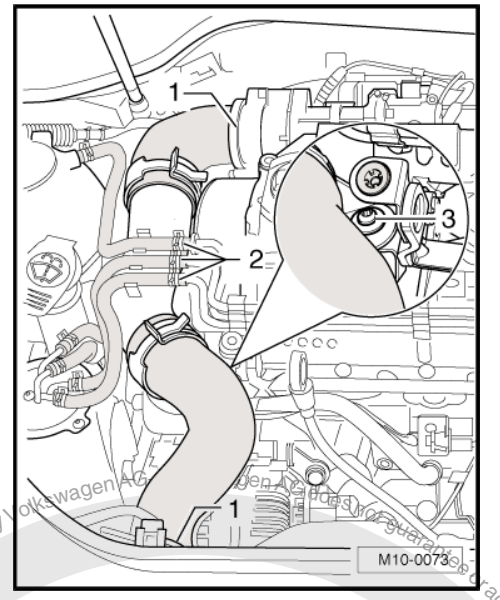
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.



Note

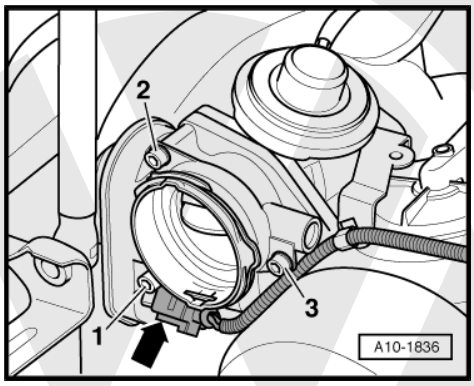
The hoses -2- remain connected.

– Remove air pipe. To do this lift retaining clips -1- slightly and remove the bolt -3- from the transport bracket.



– Disconnect connector -arrow- on intake manifold flap motor -V157- .

– Remove bolts -1…3- and take intake manifold flap motor -V157- off.



1.11.2 Installing

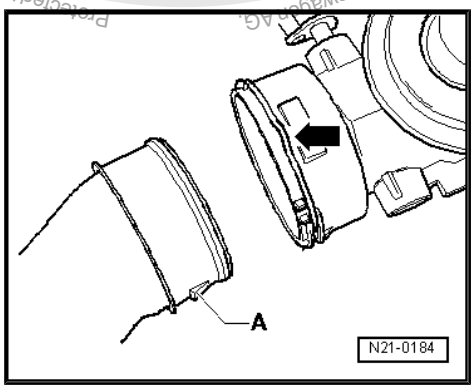
Install in reverse order. In the process, note the following:

Note

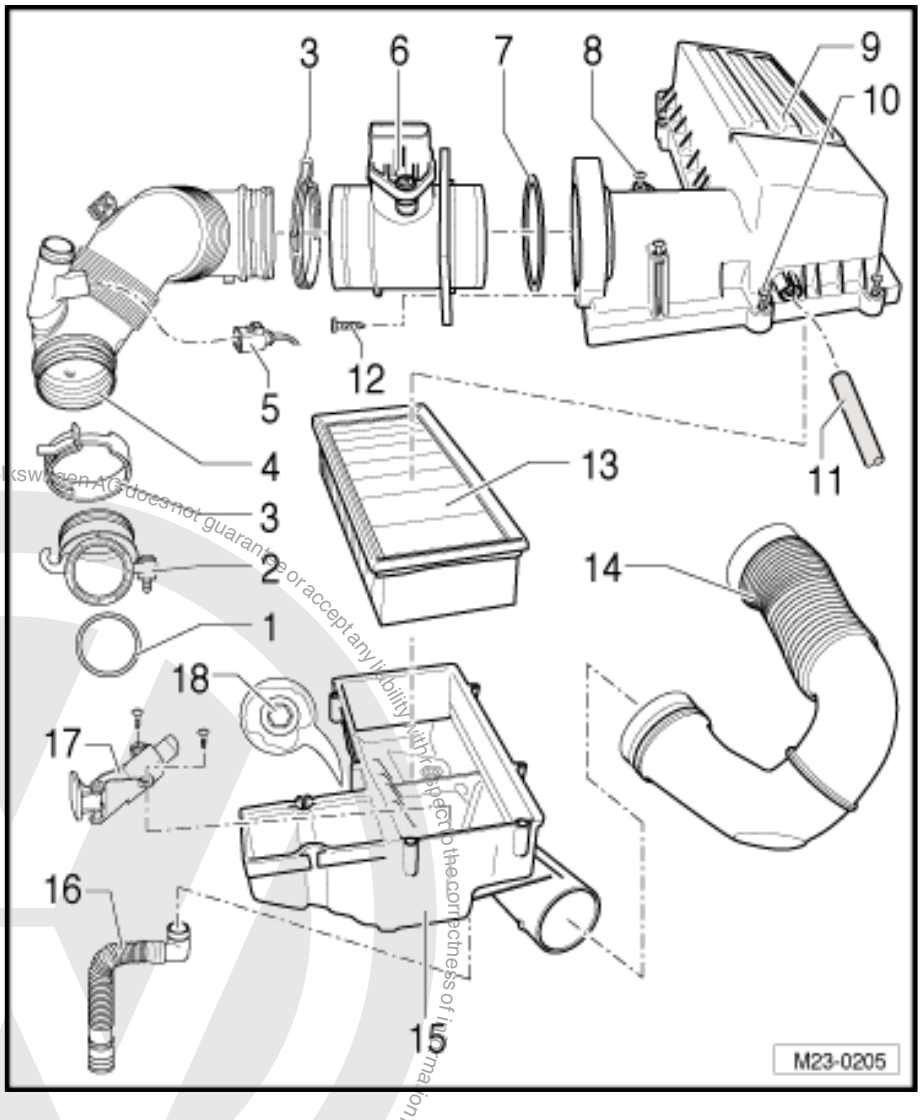
- *Renew gaskets and seals.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA" .*

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.

– Tighten bolts for intake manifold flap motor -V157- to 10 Nm.



1.12 Assembly overview - air filter



1 - O-ring
- ❑ Renew if damaged.

2 - Connector

3 - Hose clip

4 - Intake hose
- ❑ To turbocharger

5 - Connector
- ❑ For heater element for crankcase breather - N79- .
- ❑ Only fitted in vehicles with cold country equipment

6 - Air mass meter -G70-

7 - O-ring
- ❑ Renew.

8 - 8 Nm

9 - Air filter upper part

10 - 8 Nm

11 - Vacuum hose
- ❑ To solenoid valve block

12 - 6 Nm

13 - Filter element

14 - Air duct
- ❑ To lock carrier.

15 - Air filter lower part

16 - Water outlet pipe

17 - Flap for warm air intake
- ❑ With thermal element.
- ❑ Integrated in air cleaner lower section
- ❑ Can not be renewed individually.

18 - 10 Nm

1.13 Connection diagram for charge pressure control, engine codes BKC, BXE

1 - Mechanical exhaust gas recirculation valve

2 - Vacuum reservoir

3 - To vacuum unit for charge pressure control

4 - To vacuum unit for exhaust gas recirculation cooler change-over

5 - Solenoid valve block

- ❑ With exhaust gas recirculation valve 1 - N18-
- ❑ With charge pressure control solenoid valve - N75-
- ❑ With exhaust gas recirculation cooler change-over valve -N345-
- ❑ Connection diagram ⇒ page 238

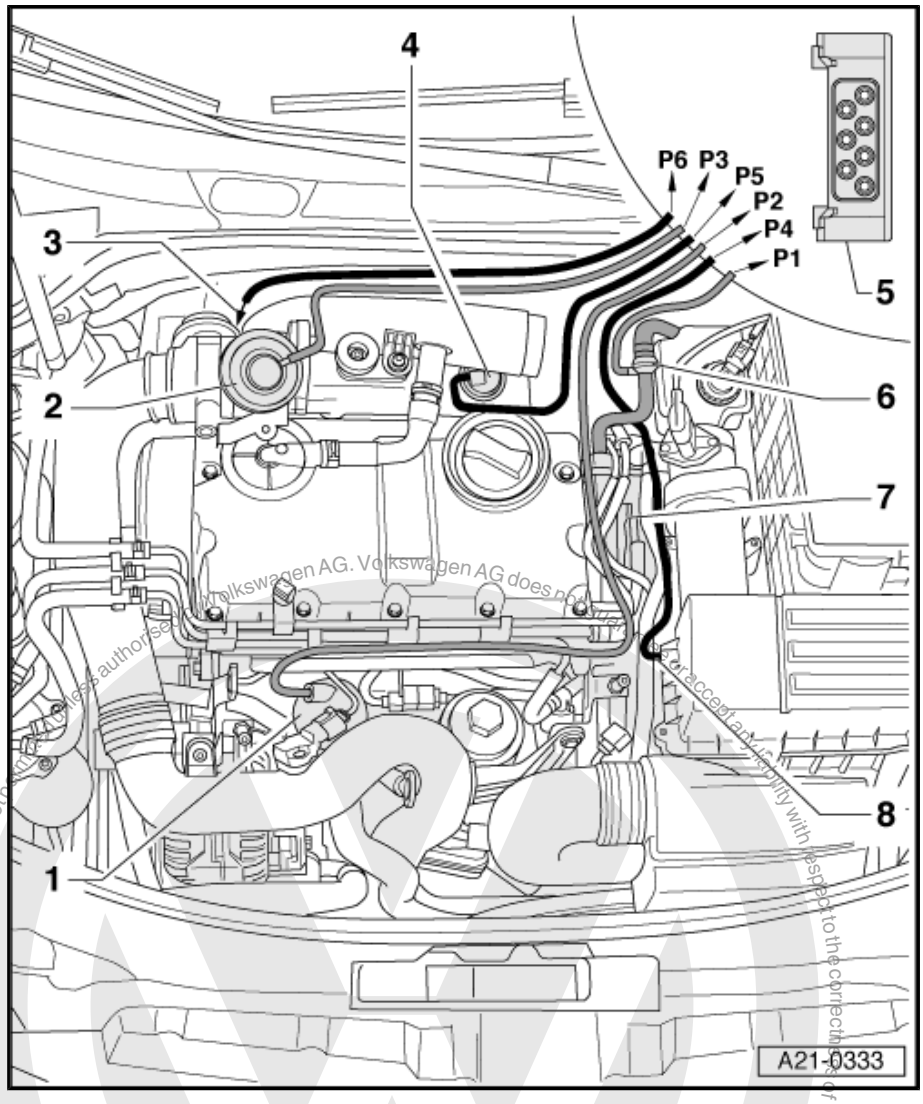
6 - Vacuum supply line

- ❑ From the tandem pump to the solenoid valve block

7 - Tandem pump

8 - Breather hose

- ❑ To air filter



1.14 Connection diagram for solenoid valve block, engine codes BKC, BXE

P1 - Vacuum supply line from the tandem pump

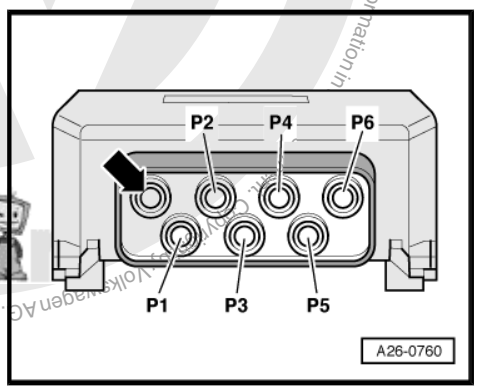
P2 - To mechanical exhaust gas recirculation valve

P3 - To vacuum unit for exhaust gas recirculation cooler change-over

P4 - Breather hose to air filter

P5 - To vacuum reservoir

P6 - To vacuum unit for charge pressure control



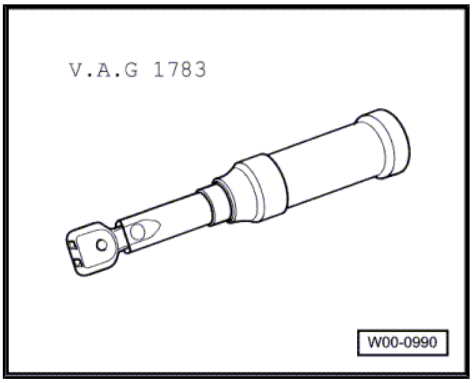
Note

The vacuum connection marked with an -arrow- is not used and is closed in the connection cap.

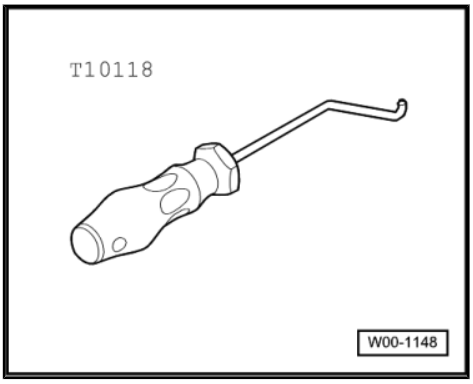
1.15 Removing and installing engine speed sender -G28-

Special tools and workshop equipment required

- Torque wrench -V.A.G 1783-



- Puller -T10118-



Removing ⇒ page 239

Installing ⇒ page 240

1.15.1 Removing

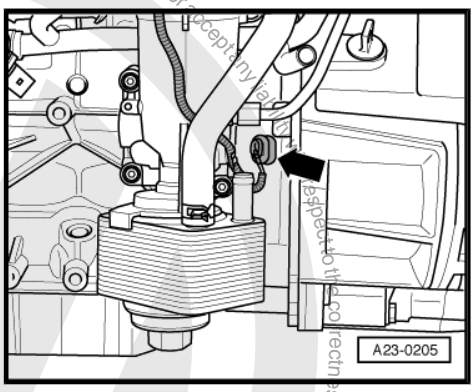
– Remove oil filter bracket ⇒ page 107 .

– Disconnect connector -arrow- on engine speed sender -G28- using assembly tool -T10118- .

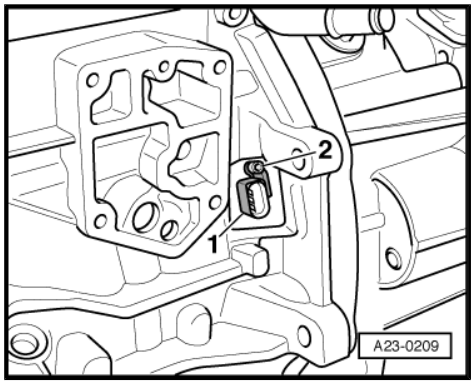
Note

To unlock connector without assembly tool -T10118- , press connector to engine speed sender with a screwdriver and raise release button with a thin wire hook at the same time.

– Move wire clear.



– Remove the securing bolt -2- of the engine speed sender -G28- -1-.

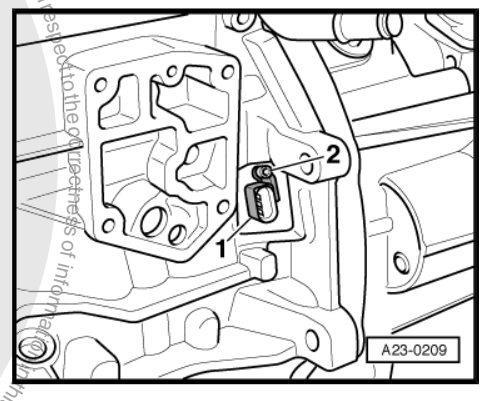


1.15.2 Installing

Install in reverse order. In the process, note the following:

– Tighten securing bolt -2- of the engine speed sender -G28- -1- to 5 Nm.

– Install oil filter bracket ⇒ page 107 .



1.16 Removing and installing engine speed sender - G28-

The sender wheel for engine speed sender -G28- is removed and installed together with the crankshaft sealing flange -flywheel end- ⇒ page 38 .

1.17 Removing and installing automatic glow period control unit - J179-

Removing ⇒ page 240

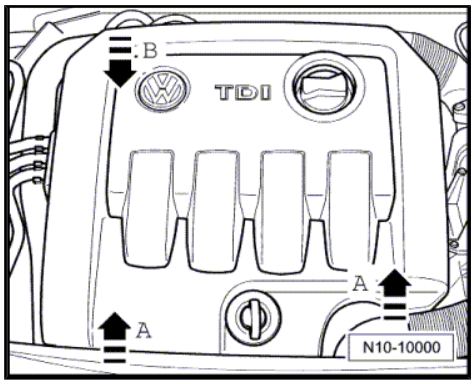
Installing ⇒ page 242

1.17.1 Removing

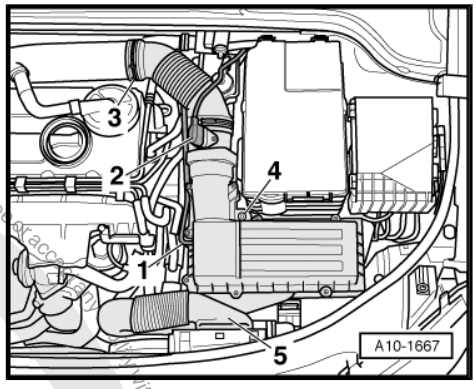
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

Vehicles with engine codes BKC, BXE

– Remove air filter housing with air mass meter and connecting pipe.



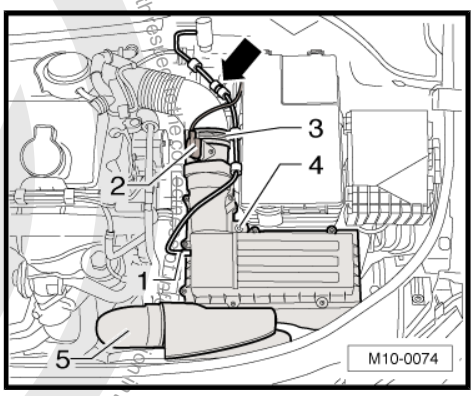
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- and air duct hoses -3- and -5- off.
– Unscrew bolt -4- and take off air filter housing.



Vehicles with engine codes BLS, BRM

– Remove air cleaner housing with air mass meter.

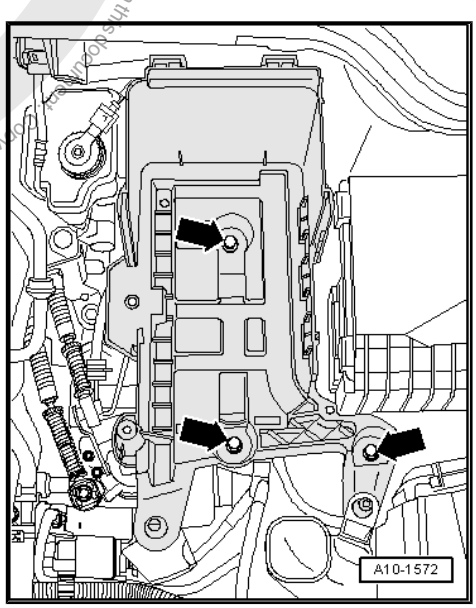
– Disconnect connector -2- on air mass meter -G70- .
– Pull breather hose -1- off and unhook from bracket -arrow-.
– Release spring-type clip -3- with spring-type clip pliers -VAS 5024A- and pull intake hose off air mass meter -G70- .
– Pull intake manifold -5- off the air duct.
– Unscrew bolt -4- and take off air filter housing.



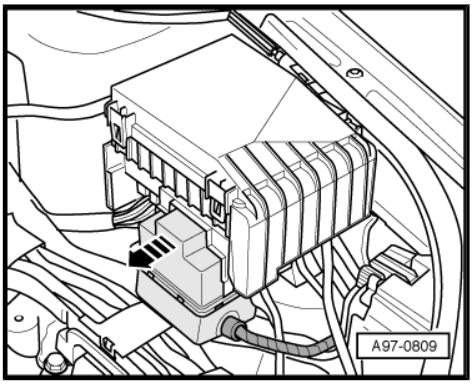
Continuation for all models

– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with diesel engine .

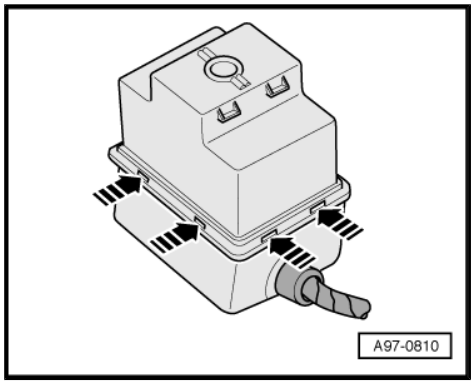
– Remove battery tray -arrows-.



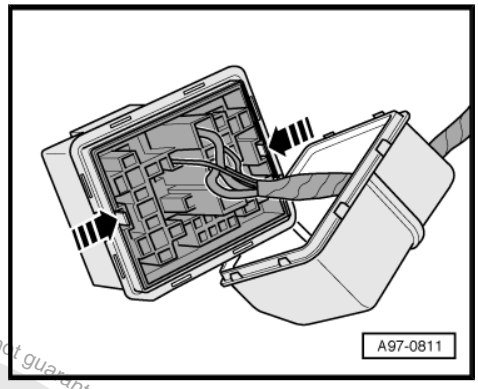
– Pull 6-pin relay carrier under electronics box off, engine compartment in -direction of arrow-.



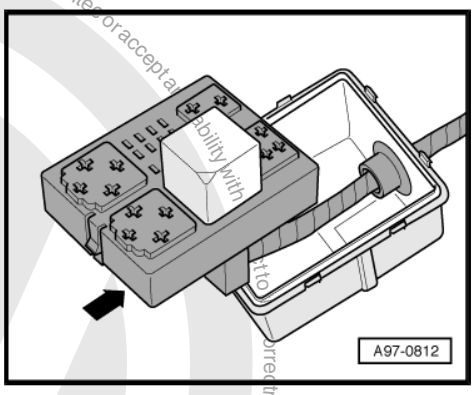
– Unclip 6-pin relay carrier cover -arrows-.



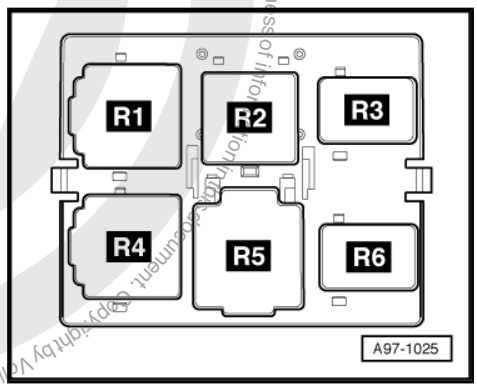
– Release retaining clips -arrows-.



– Take 6-pin relay carrier -arrow- out of cover.



– Remove automatic glow period control unit -J179- from plug position -R2-.



1.17.2 Installing

Install in reverse order. In the process, note the following:

– Installing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with diesel engine .

2 Engine control unit

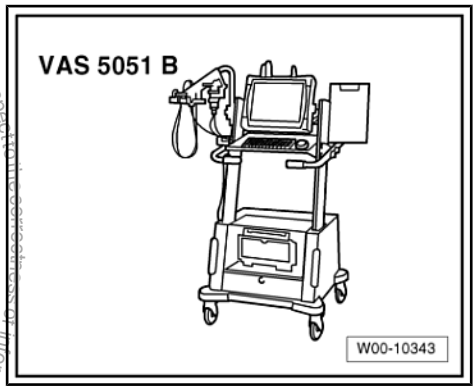
Reading and erasing engine control unit fault memory
⇒ page 243

Removing and installing engine control unit ⇒ page 245 .

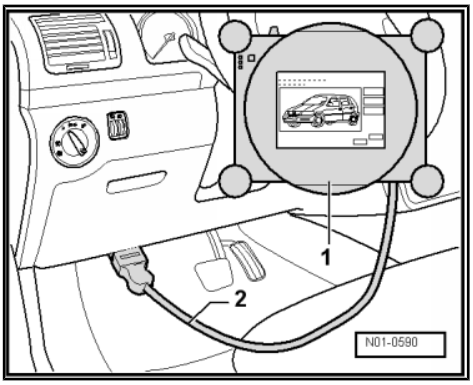
2.1 Reading and clearing engine control unit fault memory

Special tools and workshop equipment required

- Vehicle diagnosis, testing and information system -VAS 5051B-



Connect vehicle diagnosis, testing and information system -VAS 5051B- as follows:



– Fit the connector of the diagnosis cable -2- to the diagnosis connection in the driver footwell.

– Start engine and run at idling speed.

Only if engine does not start:

– Switch on ignition.

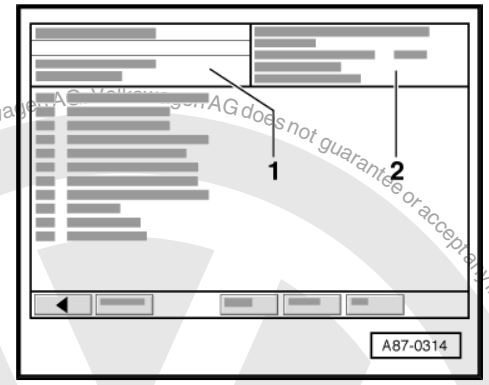
Select operating mode:

– Press key on display for “Vehicle self-diagnosis”.

Select vehicle system:

– Press button “01 - Engine electronics” on display.

The display shows the control unit identification and coding -2- as well as the chassis number and the identification number of the immobilizer (centre part).



Note

A print-out can be made if required. Press the "Print" button.

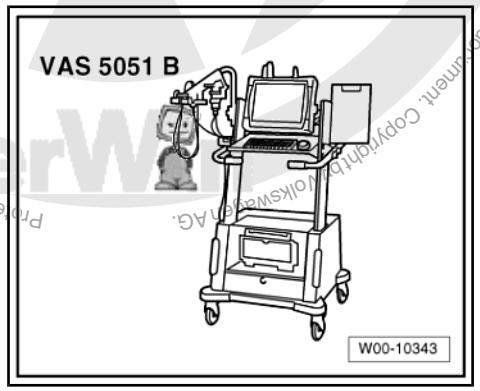
Select diagnostic function:

- Press key "02 - Read fault memory" on display.
- If no fault is stored in engine control unit "0 fault detected" is displayed.
- If faults are stored in the engine control unit, these are shown one below the other on the display.
- Press the ↵ button.
- Press key "05 - Erase fault memory" on display.
- Press function "06-End output".

2.2 Adapting functions and components

Special tools and workshop equipment required

- Vehicle diagnosis, testing and information system -VAS 5051B-



- Push diagnosis cable connector onto diagnosis connector in driver footwell.
- Switch on ignition.
- Select "Guided fault finding" in the Vehicle diagnosis, testing and information system -VAS 5051-.

After all control units have been read:

- Press key Go to.
- Select "Function/Component selection".
- Select "Drive train".
- Select "Engine code".
- Select "01 - On Board Diagnostic (OBD)".
- Select "Engine management".
- Select "Functions"
- Select "Function or component".

2.3 Removing and installing engine control unit

Removing and installing engine control unit without theft protection ⇒ page 245

Removing and installing engine control unit with theft protection ⇒ page 245

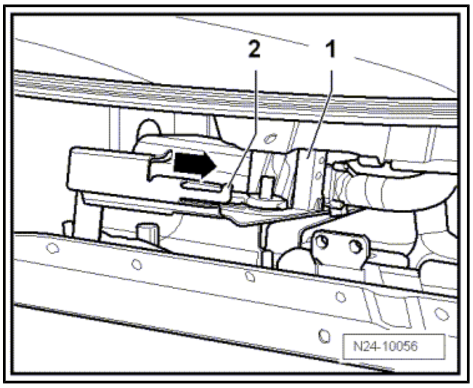
2.3.1 Removing and installing engine control unit without theft protection

Note

If you wish to replace the engine control unit, connect the Vehicle diagnosis, testing and information system -VAS 5051B- and carry out the guided function “Renew control unit”.

Removing

- Switch off ignition.
- Remove wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .
- Remove bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .
- Release front connector -1- from engine control unit and pull it off.
- Lever up catch -2- slightly.
- Then push engine control unit out of retainer -arrow-.
- Then release rear connector on engine control unit and pull it off.



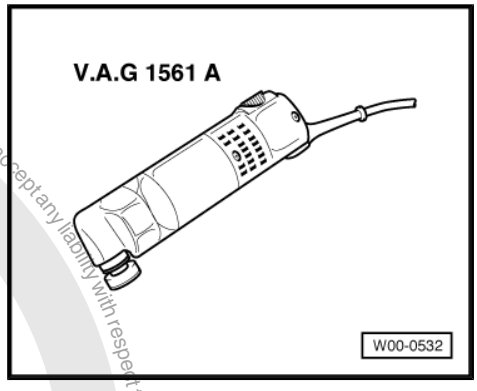
Installing

- Fit rear connector to engine control unit and lock it in position.
- Push engine control unit onto bracket.
- Fit front connector to engine control unit and lock it in position.
- Install bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .
- Install wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .

2.3.2 Removing and installing anti-theft engine control unit

Special tools and workshop equipment required

- Electric cutter -V.A.G 1561A-



- Saw set -V.A.G 1561/14-
- Pliers

Note

If you wish to replace the engine control unit, connect the Vehicle diagnosis, testing and information system -VAS 5051B- and carry out the guided function "Renew control unit".

Removing

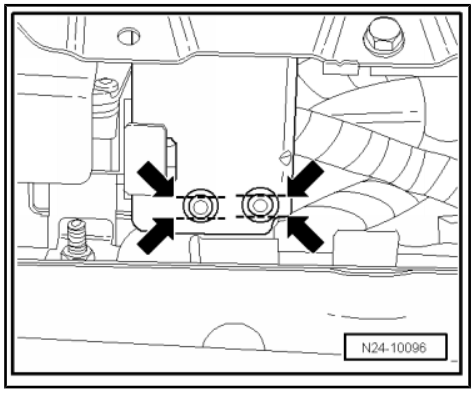
– Switch off ignition.

– Remove wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .

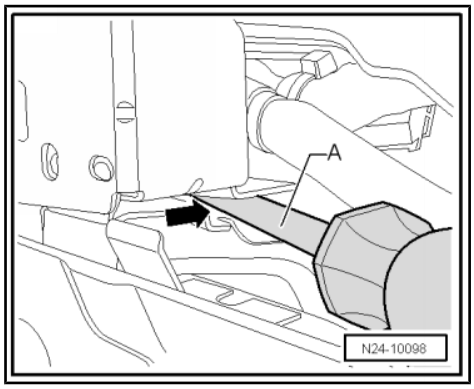
– Remove bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .

– Saw shear head bolts so that two parallel surfaces are created -arrows-.

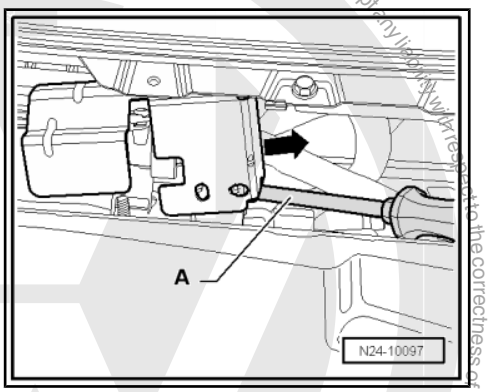
– Remove bolts with pliers .



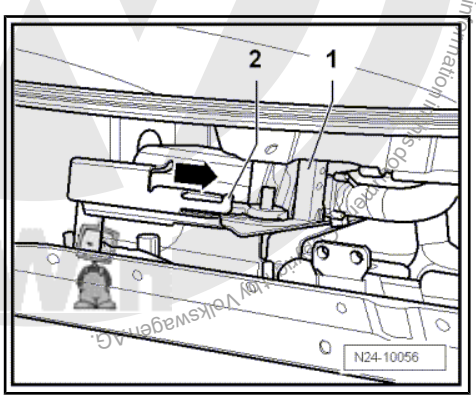
– Insert a screwdriver between protective housing -A- and bracket -arrow-.



– Lever the protective housing out upwards using the screwdriver -A- and pull it off sideways from the retaining plate -arrow-.



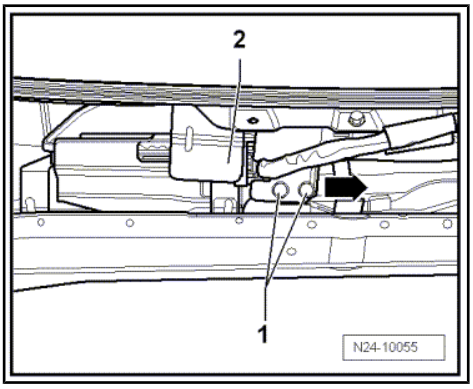
– Release front connector -1- from engine control unit and pull it off.
– Lever up catch -2- slightly.
– Then push engine control unit out of retainer -arrow-.
– Then release rear connector on engine control unit and pull it off.



Installing

– Fit rear connector to engine control unit and lock it in position.
– Push engine control unit onto bracket.
– Fit front connector to engine control unit and lock it in position.
– Push protective housing onto bracket.

– Tighten new shear bolts -1- evenly until heads shear off.
– Install bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .
– Install wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .



26 – Exhaust system

1 Exhaust system

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

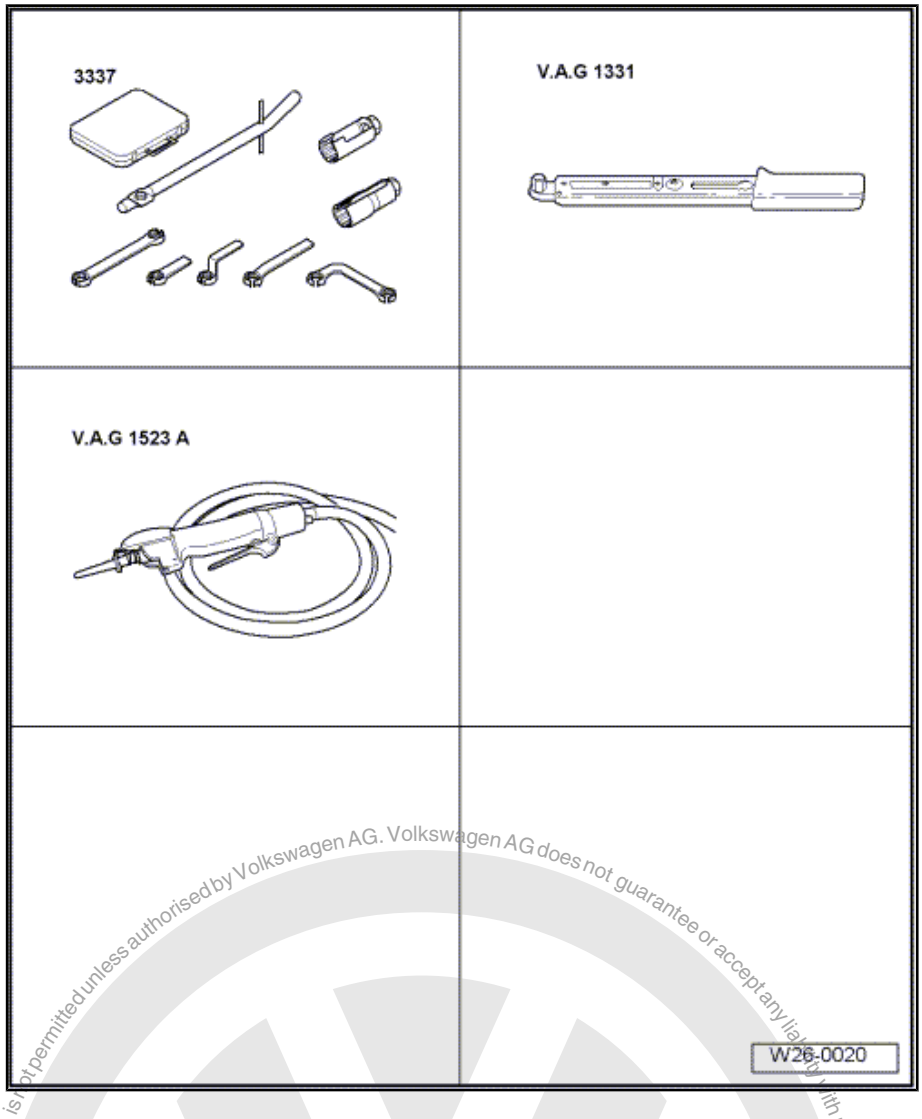
- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant, refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***

Note

- *The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.*
- *Renew seals, gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen clamp-type clip and align silencer and exhaust pipe so that sufficient clearance is maintained to the body and the support rings are evenly loaded.*
- *The exhaust manifold and the turbocharger are one component, removing and installing* ⇒ page 177 .

Special tools and workshop equipment required

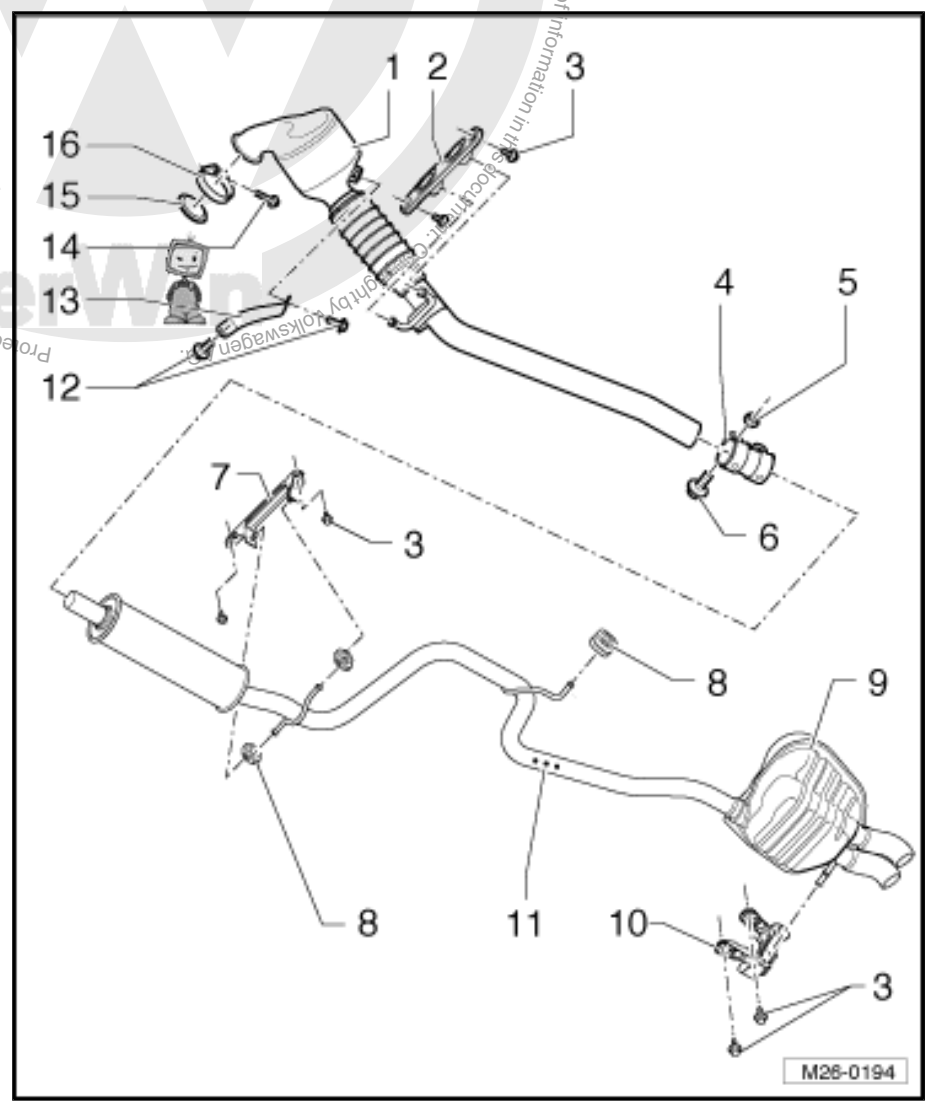
- Lambda probe open ring spanner set -3337 -
- Torque wrench -V.A.G 1331-
- Pneumatic sabre saw - V.A.G 1523 A-
- Hot bolt paste ⇒ Electronic parts catalogue“ ETKA”



1.1 Parts of exhaust system - Assembly overview

1.1.1 Parts of exhaust system - Assembly overview, engine codes BKC, BXE

The exhaust manifold and the turbocharger are one component, removing and installing ⇒ page 177 .



1 - Front exhaust pipe with catalytic converter

2 - Mounting
- ❑ Renew if damaged.

3 - 25 Nm

4 - Clamp-type clip

5 - 25 Nm

6 - Bolt/screw

7 - Mounting

8 - Retaining ring for front silencer
- ❑ Renew if damaged.

9 - Front and rear silencers
- ❑ For repairs, renew individually.

10 - Mounting
- ❑ With support loop
- ❑ Renew if damaged.

11 - Connection point
- ❑ For repairs
- ❑ Marked by three indentations on circumference of exhaust pipe.
- ❑ During production, front and rear silencers are installed as a single component. For repairs, front and rear silencers are supplied separately.
- ❑ The connection is made with a clamp-type clip.

- ❑ Separating front and rear silencers ⇒ page 259
- ❑ Fitting location of rear clamp-type clip (repair double clamp) ⇒ page 260
- ❑ Evenly tighten threaded connections on clamp-type clip (repair double clamp).
- ❑ Torque settings for clamp-type clip (repair double clamp): M8 = 25 Nm
- ❑ Aligning exhaust system free of stress ⇒ page 260

12 - 40 Nm

13 - Support

14 - 7 Nm

15 - Seal

- ❑ Renew.
- ❑ Note installation position.

16 - Clip

1.1.2 Parts of exhaust system - Assembly overview, engine codes BLS (with catalytic converter), BRM

The exhaust manifold and the turbocharger are one component, removing and installing ⇒ page 188 .

1 - Front exhaust pipe with catalytic converter

- ❑ Engine code BLS with preparation for diesel particulate filter

2 - Lambda probe -G39-

3 - Clip

4 - Seal

- ❑ Renew.
- ❑ Note installation position.

5 - 7 Nm

6 - Mounting

- ❑ Renew if damaged.

7 - 25 Nm

8 - Clamp-type clip

9 - 25 Nm

10 - Retaining ring for front silencer

- ❑ Renew if damaged.

11 - Front and rear silencers

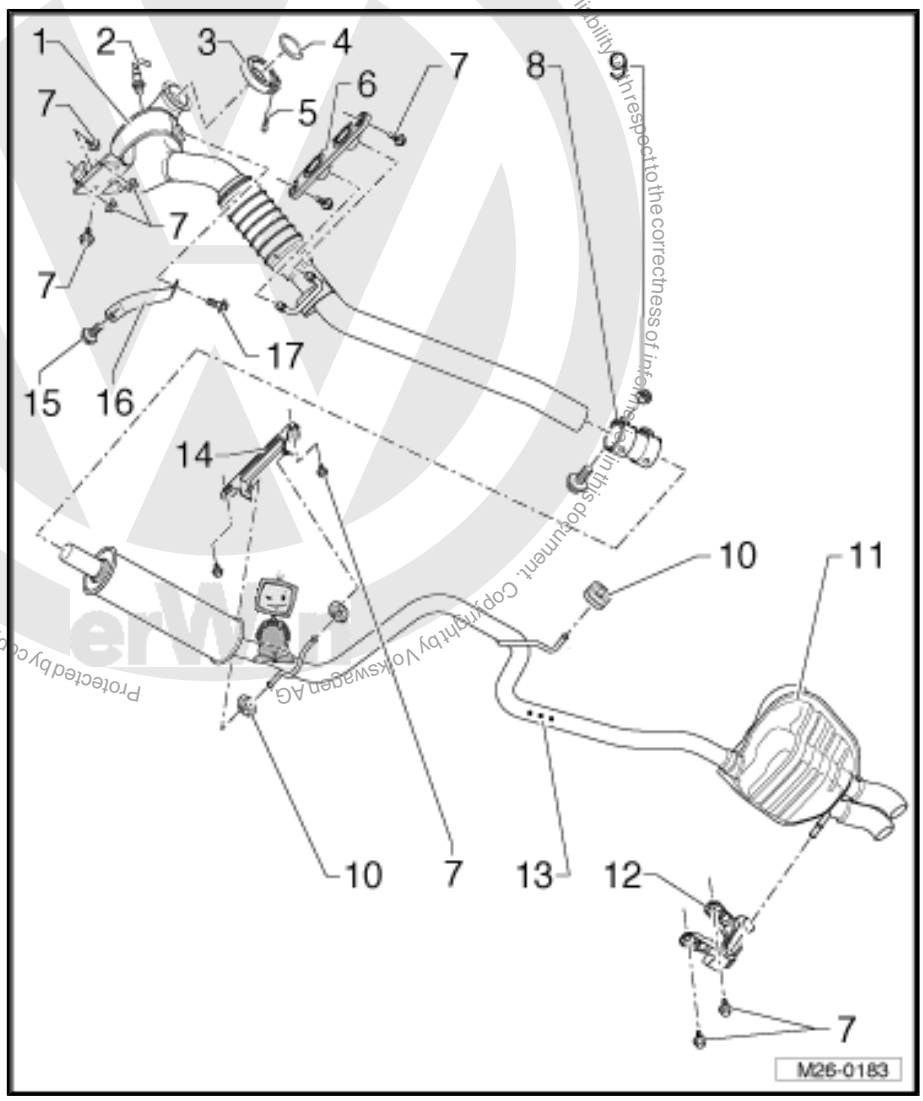
- ❑ For repairs, renew individually.

12 - Mounting

- ❑ With support loop
- ❑ Renew if damaged.

13 - Connection point

- ❑ For repairs



- ❑ Marked by three indentations on circumference of exhaust pipe.
- ❑ During production, front and rear silencers are installed as a single component. For repairs, front and rear silencers are supplied separately.
- ❑ The connection is made with a clamp-type clip.
- ❑ Separating front and rear silencers ⇒ page 259
- ❑ Fitting location of rear clamp-type clip (repair double clamp) ⇒ page 260
- ❑ Evenly tighten threaded connections on clamp-type clip (repair double clamp).
- ❑ Torque settings for clamp-type clip (repair double clamp): M8 = 25 Nm
- ❑ Aligning exhaust system free of stress ⇒ page 260

14 - Mounting

15 - 40 Nm

16 - Support

17 - 40 Nm

1.1.3 Front exhaust pipe - Assembly overview, engine code BLS (with diesel particulate filter)

1 - 8 Nm

2 - Exhaust gas pressure sensor 1 -G450-

3 - Retainer

- ❑ For control lines

4 - 10 Nm

5 - Control line, 45 Nm

6 - Lambda probe -G39- , 50 Nm

- ❑ Grease threads only with hot bolt paste - G 052 112 A3- , hot bolt paste - G 052 112 A3- must not get into the slots of probe body.
- ❑ To remove use lambda probe open ring spanner set -3337-

7 - Exhaust gas temperature sender bank 2 -G448 - , 45 Nm

- ❑ Lubricate thread of sender using hot bolt paste - G 052 112 A3-

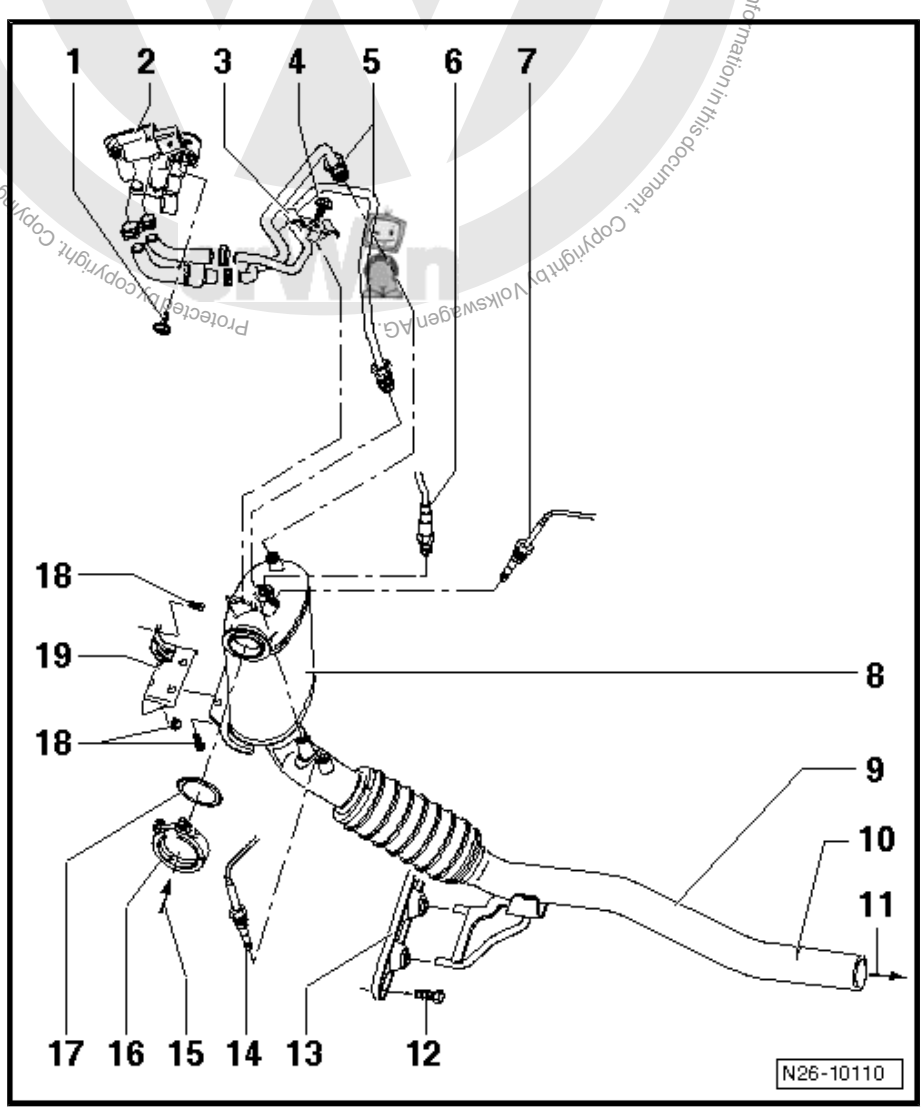
8 - Particulate filter

- ❑ Removing and installing ⇒ page 257 .

9 - Front exhaust pipe

10 - Marking

- ❑ For clamp.



11 - To front silencer

12 - 25 Nm

13 - Mounting

- ❑ Renew if damaged.

14 - Exhaust gas temperature sender 3 -G527-

- ❑ Lubricate thread of sender using hot bolt paste - G 052 112 A3-

15 - From turbocharger

16 - Clamp, 7 Nm

17 - Seal

- ❑ Renew.
- ❑ Note installation position.

18 - 25 Nm

19 - Retainer

- ❑ Bolted to cylinder head

1.1.4 Silencer - Assembly overview, engine code BLS (with diesel particulate filter)

1 - From diesel particulate filter

2 - 25 Nm

- ❑ Renew.

3 - Clamp-type clip

4 - 25 Nm

5 - Retainer

- ❑ For retaining rings

6 - Retaining rings

- ❑ Renew if damaged.

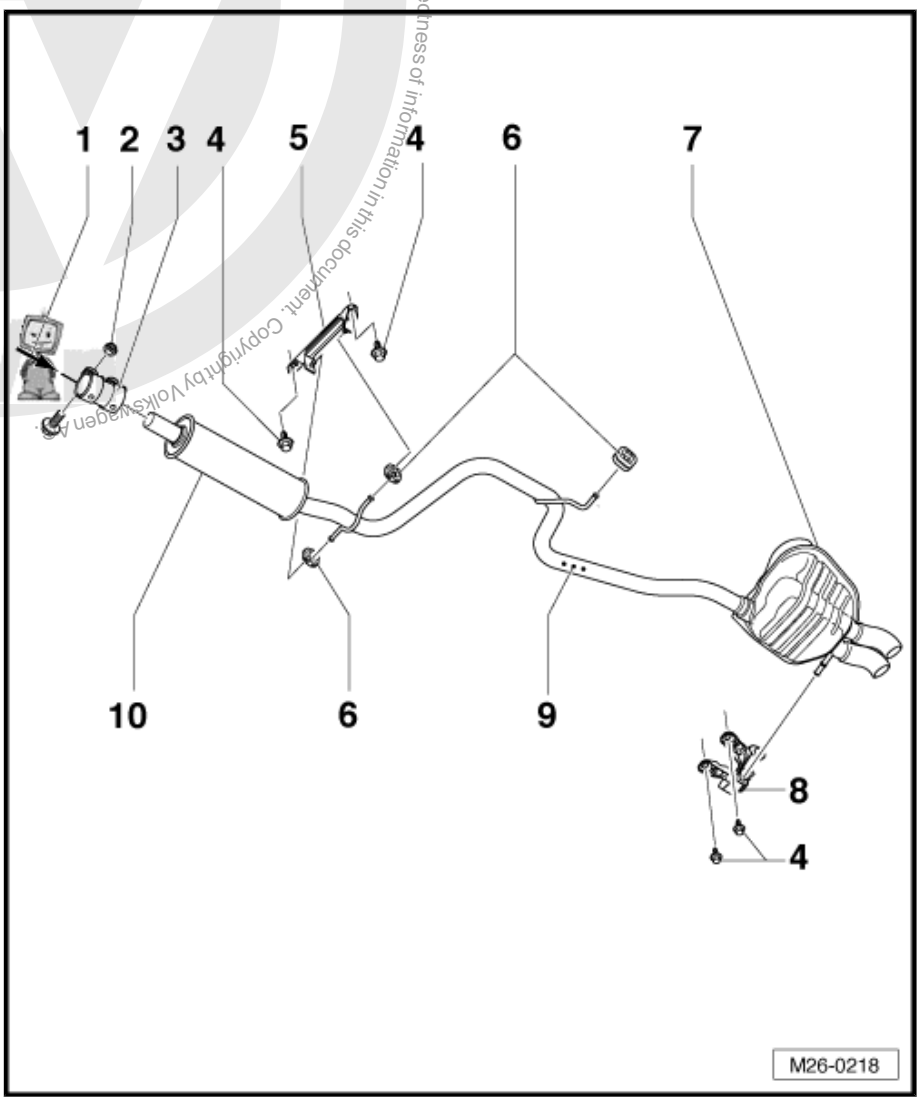
7 - Rear silencer

8 - Mounting

- ❑ Renew if damaged.

9 - Connection point

- ❑ For repairs
- ❑ Marked by three indentations on circumference of exhaust pipe.
- ❑ During production, front and rear silencers are installed as a single component. For repairs, front and rear silencers are supplied separately.
- ❑ The connection is made with a clamp-type clip.
- ❑ Separating front and rear silencers ⇒ page 259
- ❑ Fitting location of rear clamp-type clip (repair double clamp)



⇒ page 260

- ❑ Evenly tighten threaded connections of clamp (repair double clamp).
- ❑ Torque settings for clamp (repair double clamp): M8 = 25 Nm
- ❑ Aligning exhaust system free of stress ⇒ page 260

10 - Front silencer

1.2 Removing and installing front exhaust pipe

Removing and installing front exhaust pipe with catalytic converter, engine codes BKC, BXE ⇒ page 254

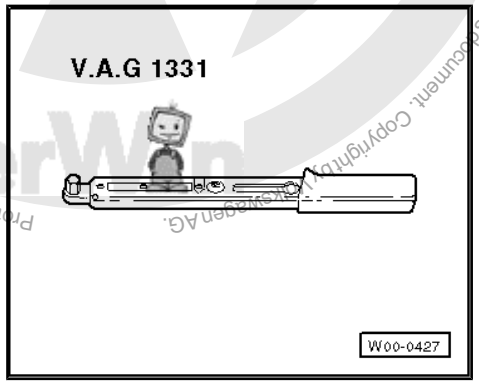
Removing and installing front exhaust pipe with catalytic converter, engine codes BLS, BRM ⇒ page 255

Removing and installing front exhaust pipe with diesel particulate filter, engine code BLS ⇒ page 257

1.2.1 Removing and installing front exhaust pipe with catalytic converter, engine codes BKC, BXE

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331-



Removing ⇒ page 254

Installing ⇒ page 255

Removing

– Disconnect Lambda probe connector on plenum chamber bulkhead.

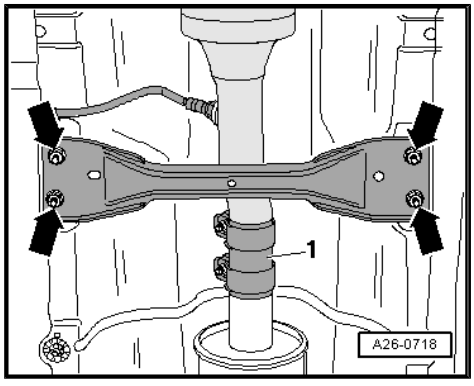
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Loosen clamp-type clip bolts -1-.

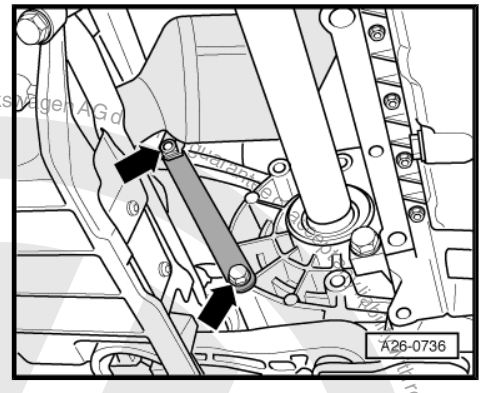
Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.

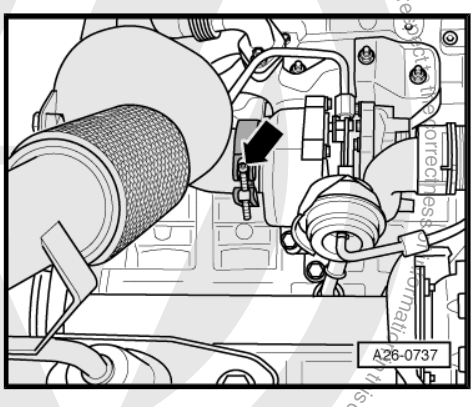
– Remove front cross member -arrows-.



– Unscrew strut -arrows-.



– Open clamp -arrow- and take exhaust pipe off turbocharger.



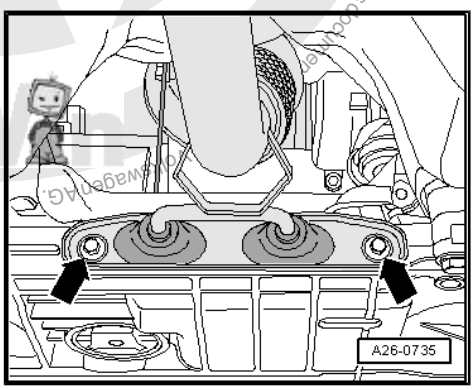
– Remove exhaust pipe retainer -arrows-.
– Slide clamp-type clip backwards and take exhaust pipe off.

Installing

Install in reverse order. In the process, note the following:

– Renew seal.
– Align exhaust system free of stress ⇒ page 260 .

Torque settings

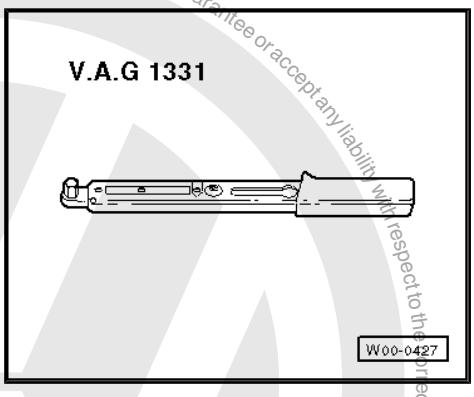


Component	Nm
Front exhaust pipe to turbocharger	7
Mounting to subframe	25
Strut to gearbox and front exhaust pipe	40
Front cross member to body	25

1.2.2 Removing and installing front exhaust pipe with catalytic converter, engine codes BLS, BRM

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1331-



Removing ⇒ page 256

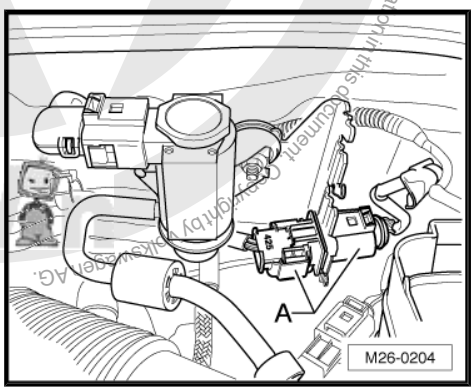
Installing ⇒ page 257

Removing

– Pull connector -A- off and disconnect.

– Pull wiring harness off the bulkhead retainers.

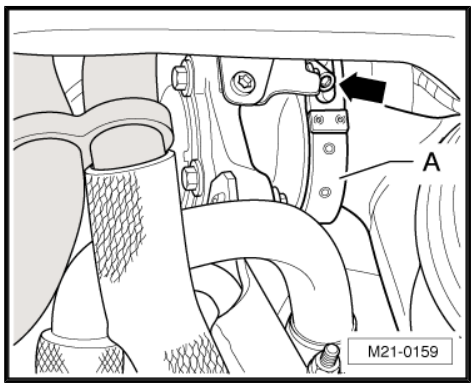
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .



– Open clamp -A-. Loosen bolt -arrow-.

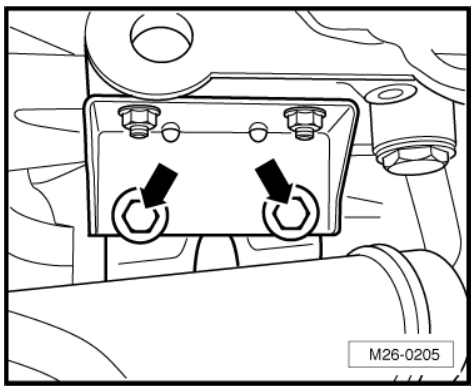
Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.

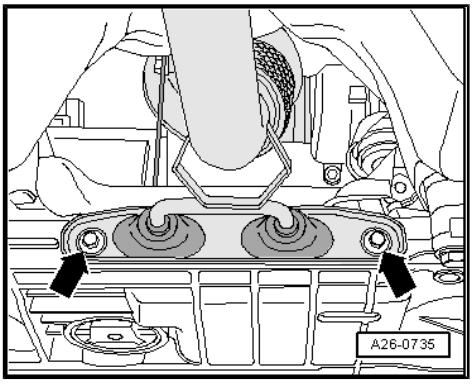


– Unscrew catalytic converter on retainer -arrows-.

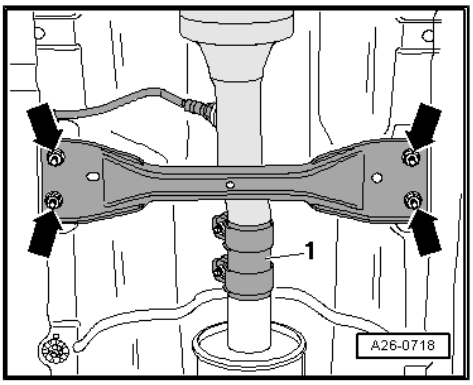
– Remove right-hand drive shaft on gearbox ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .



– Remove exhaust pipe retainer -arrows-.



– Loosen clamp-type clip bolts -1-.
– Remove front cross member -arrows-.
– Slide clamp-type clip backwards and take exhaust pipe off.
– Turn the front exhaust pipe approx. 90° to the right. Lower it to between the subframe, heat shield and coolant hoses.



Installing

Install in reverse order. In the process, note the following:

– Renew seal.
– Align exhaust system free of stress ⇒ page 260 .

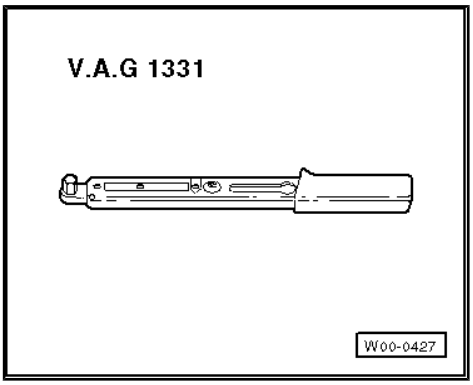
Torque settings

Component	Nm
Front exhaust pipe to turbocharger	7
Mounting to subframe	25
Front cross member to body	25

1.2.3 Removing and installing front exhaust pipe with diesel particulate filter, engine code BLS

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1331-



Removing ⇒ page 257

Installing ⇒ page 259

Removing

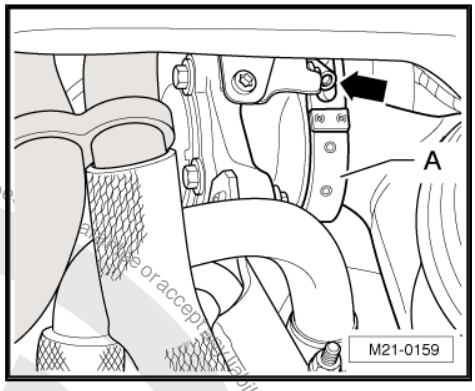
– Separate all electrical connectors to particulate filter (on bulkhead)
– Pull wiring off the bulkhead retainers.

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 .

– Unplug connector for exhaust gas temperature sender 3 - G527- .

– Remove right-hand drive shaft on gearbox ⇒ Running gear, axles, steering; Rep. Gr. 40 .

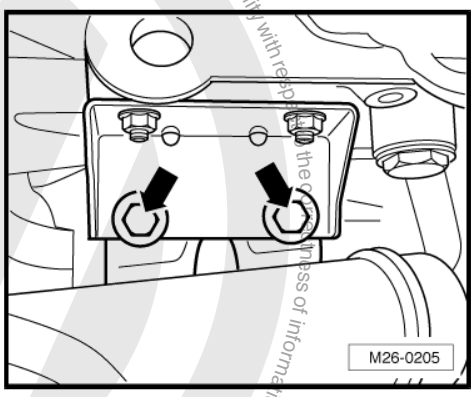
– Open clamp -A-. Loosen bolt -arrow-.



Note

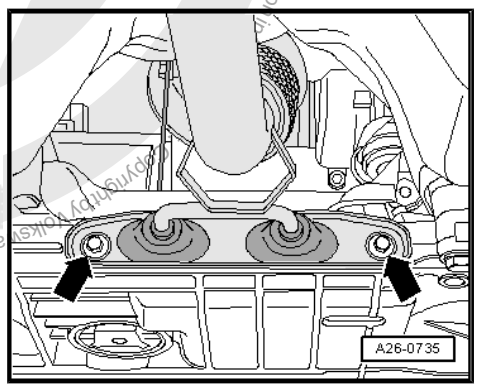
The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.

– Remove diesel particulate filter on retainer -arrows-.

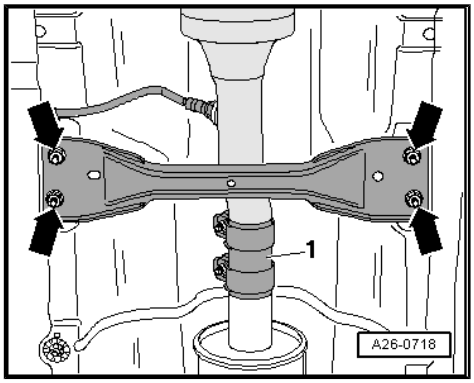


– Remove exhaust pipe retainer -arrows-.

– Remove subframe ⇒ Running gear, axles, steering; Rep. Gr. 40 .



– Loosen clamp-type clip -1-.
– Remove front cross member -arrows-.
– Slide clamp-type clip backwards and take exhaust pipe with diesel particulate filter off.



Installing

Install in reverse order. In the process, note the following:

– Renew seal.
– Align exhaust system free of stress ⇒ page 260 .

Torque settings

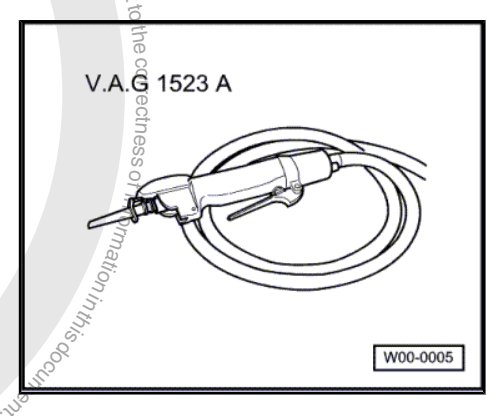
Component	Nm
Diesel particulate filter on turbocharger	7
Mounting to subframe	25
Front cross member to body	25
Diesel particulate filter on cylinder block	25

1.3 Connecting and disconnecting front and rear silencers

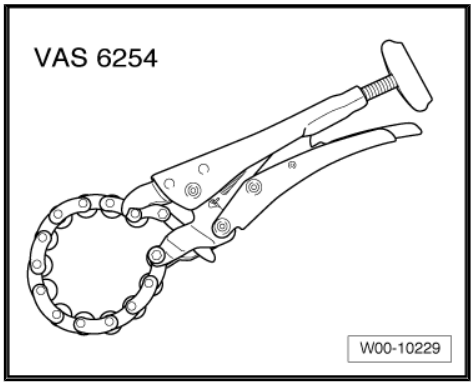
♦ To renew the front and rear silencers individually there is a separating point provided in the connecting pipe.
♦ The cutting location is marked by an indentation on the circumference of the exhaust pipe.

Special tools and workshop equipment required

♦ Pneumatic sabre saw -V.A.G 1523 A-



♦ or chain pipe cutter -VAS 6254-



♦ Eye protection

Separate

WARNING

To avoid injury from metal shavings, wear eye protection and protective clothing.

– Cut through exhaust pipe -arrow 2- e.g. with body saw - V.A.G 1523 A- at right angles at the separating point.

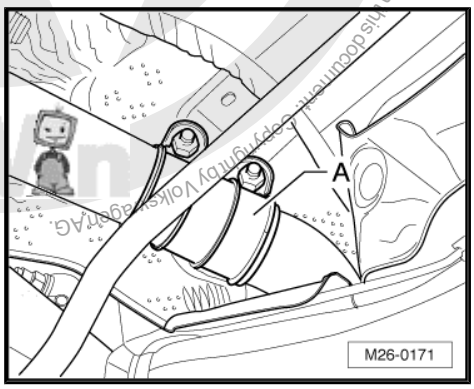
Connect

Note

A second mechanic is required to tighten the repair clamp-type clip.

– Secure front silencer in the retainers. The front clamping sleeve remains loosely pushed onto the pipes.
– Align rear silencer horizontally and hold in this position.
– Position the repair clamp-type clip at the side markings -arrow 1- and -arrow 3-.

Fitting location of rear clamp-type clip (repair double clamp)



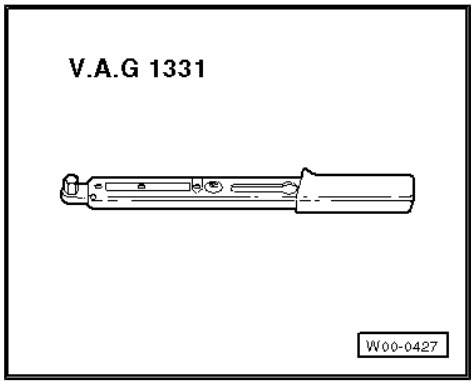
– Turn repair clamp-style clip -A- as shown.
– Install repair double clamp so that the bolt ends do not protrude beyond bottom of clamp.
– Align exhaust system free of stress when cold ⇒ page 260 .
– Tighten the repair double clamp.

Specified torque M8: 25 Nm

1.4 Stress-free alignment of exhaust system

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1331-



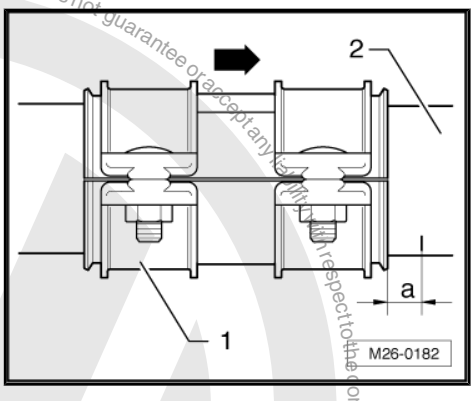
Prerequisite

- The exhaust system must be aligned when it is cold.

Procedure

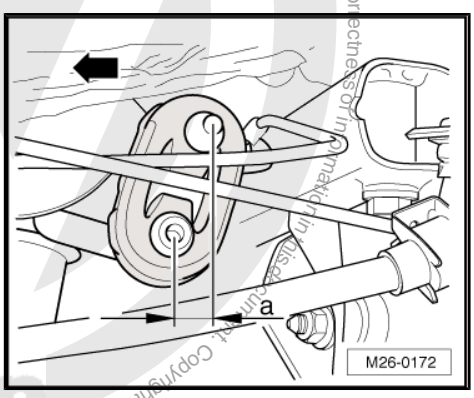
– Loosen bolts on front retaining clip -1-.

– Position clamp-type clip -1- so that the distance -a- to the marking on the pipe -2- is 5 mm and tighten front bolt by hand. The -arrow- points in direction of travel.



– Move the exhaust system with silencer forwards until the dimension -a- = 9…11 mm is reached on the outer hand hold straps of the front silencer. The -arrow- points in direction of travel.

– In this position, tighten front clamp-type clip evenly to 25 Nm.

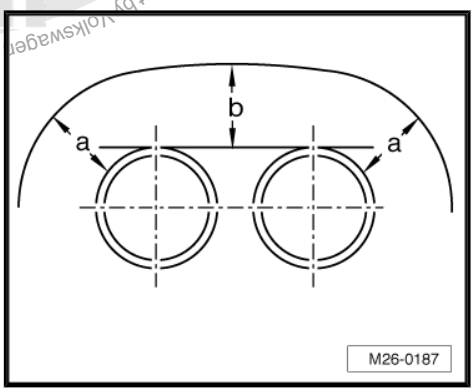


Aligning tailpipes

– Align rear silencer so that dimension -a- between bumper cut-out and end pipes on the left and right-hand sides are the same.

At the same time the distance -b- from bumper cut-out to end pipes must be parallel.

– To align tail pipe, loosen rear silencer mountings if necessary.



2 Exhaust gas recirculation system

2.1 Parts of exhaust gas recirculation - Assembly overview

2.1.1 Parts of exhaust gas recirculation - Assembly overview, engine codes BKC, BXE

Note

- *The function/control of the exhaust gas recirculation system is undertaken by diesel direct injection system control unit -J248- via exhaust gas recirculation valve -N18- (electro-pneumatic) to exhaust gas recirculation valve (mechanical).*
- *The electro-pneumatic exhaust gas recirculation valve -N18- can be found in the solenoid valve block.*
- *The mechanical cone-shaped plunger in the exhaust gas recirculation valve ensures that various cross sectional openings are possible at different plunger lifts.*
- *Pulsed control enables every conceivable valve position.*
- *Renew self-locking nuts.*
- *Solenoid valve block schematic diagram ⇒ page 238*

1 - 22 Nm

2 - Intake manifold

- ❑ With exhaust gas recirculation valve and intake manifold flap motor -V157- .
- ❑ Tighten securing bolts to 22 Nm.
- ❑ Removing and installing ⇒ page 224 .

3 - Seal

- ❑ Renew.

4 - Connecting pipe

5 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 266 .

6 - 10 Nm

7 - Exhaust manifold/turbocharger

- ❑ Removing and installing ⇒ page 177 .

8 - Connecting pipe

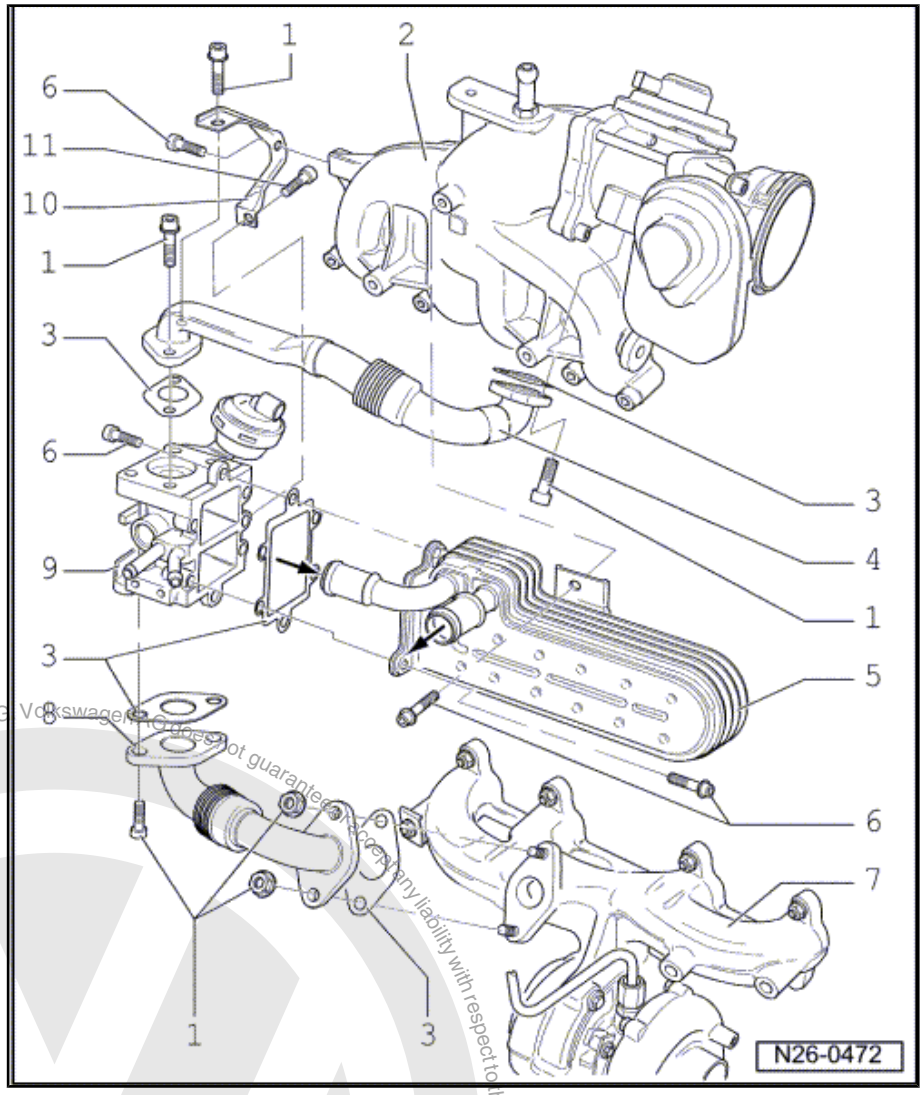
9 - Bypass flap

- ❑ Lets the exhaust gas flow into the exhaust gas recirculation cooler when the electro-pneumatic exhaust gas recirculation valve -N18- is activated

10 - Retainer

- ❑ For bypass flap.

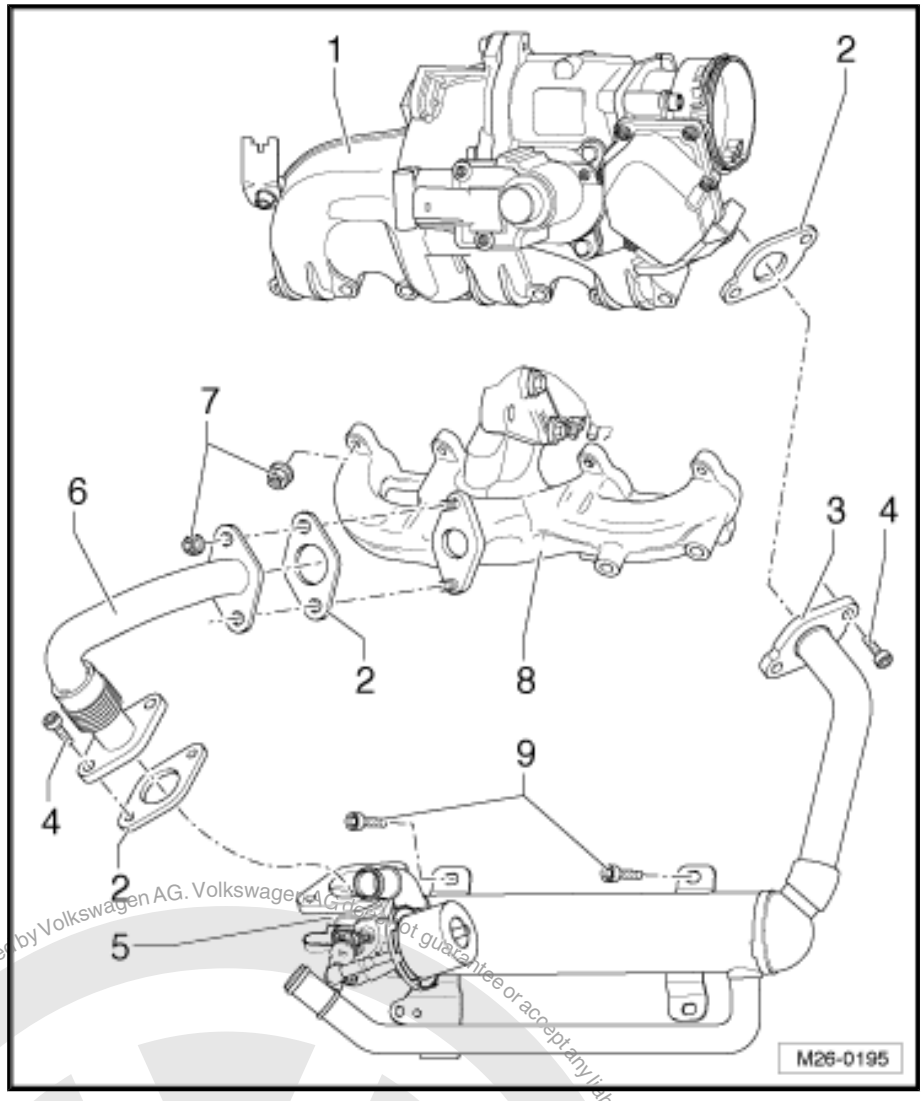
11 - 5 Nm



2.1.2 Parts of the exhaust gas recirculation - Assembly overview, engine codes BLS, BRM

Note

- ♦ *The function/control of the exhaust gas recirculation system is undertaken by diesel direct injection system control unit -J248 - via exhaust gas recirculation potentiometer -G212- .*
- ♦ *Renew self-locking nuts.*



1 - Intake manifold

- ❑ With intake manifold flap motor -V157-
- ❑ Exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18-
- ❑ Dismantling and assembling intake pipe with exhaust gas recirculation potentiometer -G212- and exhaust gas recirculation valve -N18- ⇒ page 234
- ❑ Tighten securing bolts to 22 Nm.
- ❑ Removing and installing ⇒ page 231 .

2 - Seal

- ❑ Renew.

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 271 .

4 - 22 Nm

5 - Adjustment unit for bypass flap

- ❑ Component of exhaust gas recirculation cooler

6 - Connecting pipe

7 - 22 Nm

- ❑ Renew.

8 - Exhaust manifold/turbocharger

- ❑ Removing and installing ⇒ page 188 .

9 - 10 Nm

2.2 Parts of the exhaust gas recirculation cooler - Assembly overview, engine codes BLS, BRM

1 - 22 Nm

2 - Connecting pipe

3 - 22 Nm

- ❑ Renew.

4 - Seal

- ❑ Renew.

5 - To exhaust gas recirculation cooler.

6 - To intake manifold

7 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 271 .

8 - Pipe/hose line

9 - Heat shield

10 - Spring-type clip

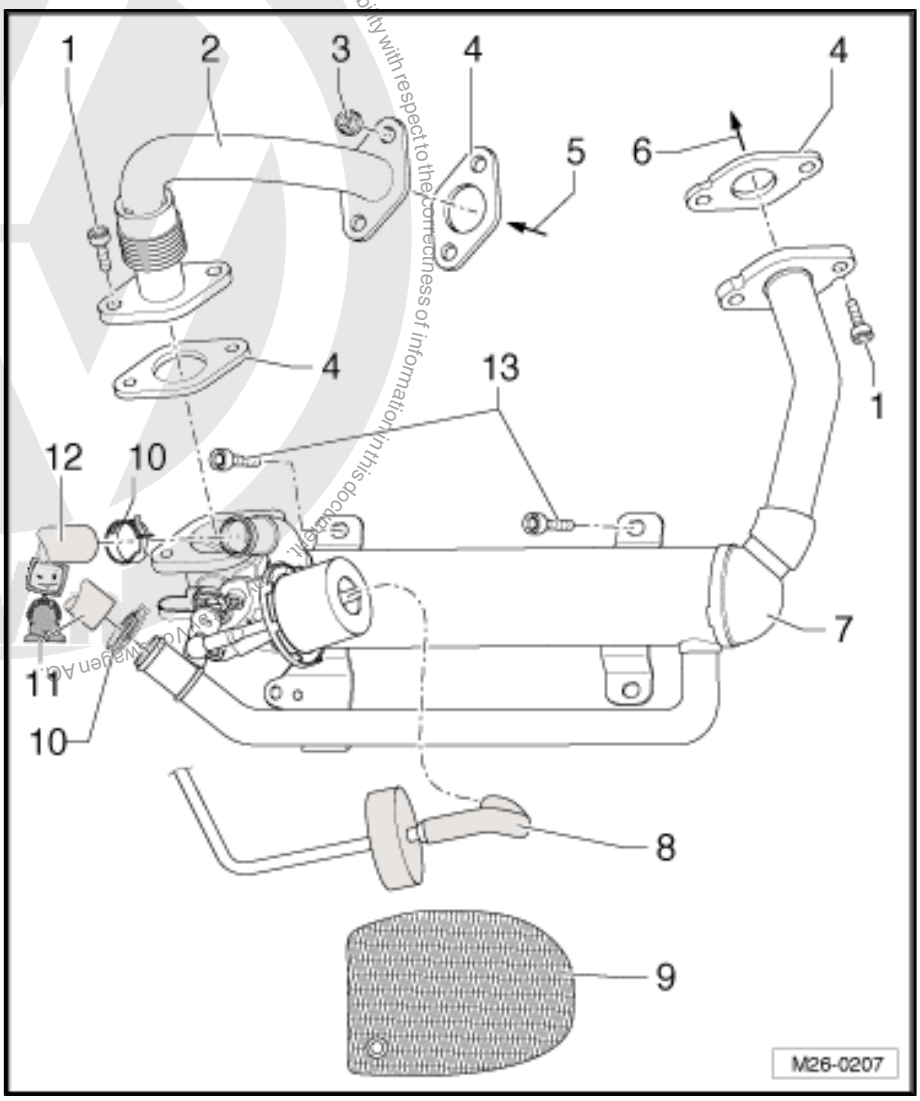
11 - Coolant hose

- ❑ To exhaust gas recirculation cooler.

12 - Coolant hose

- ❑ From exhaust gas recirculation cooler.

13 - 10 Nm



2.3 Removing and installing exhaust gas recirculation cooler

Engine codes BKC, BXE ⇒ page 266

Engine codes BLS, BRM ⇒ page 271

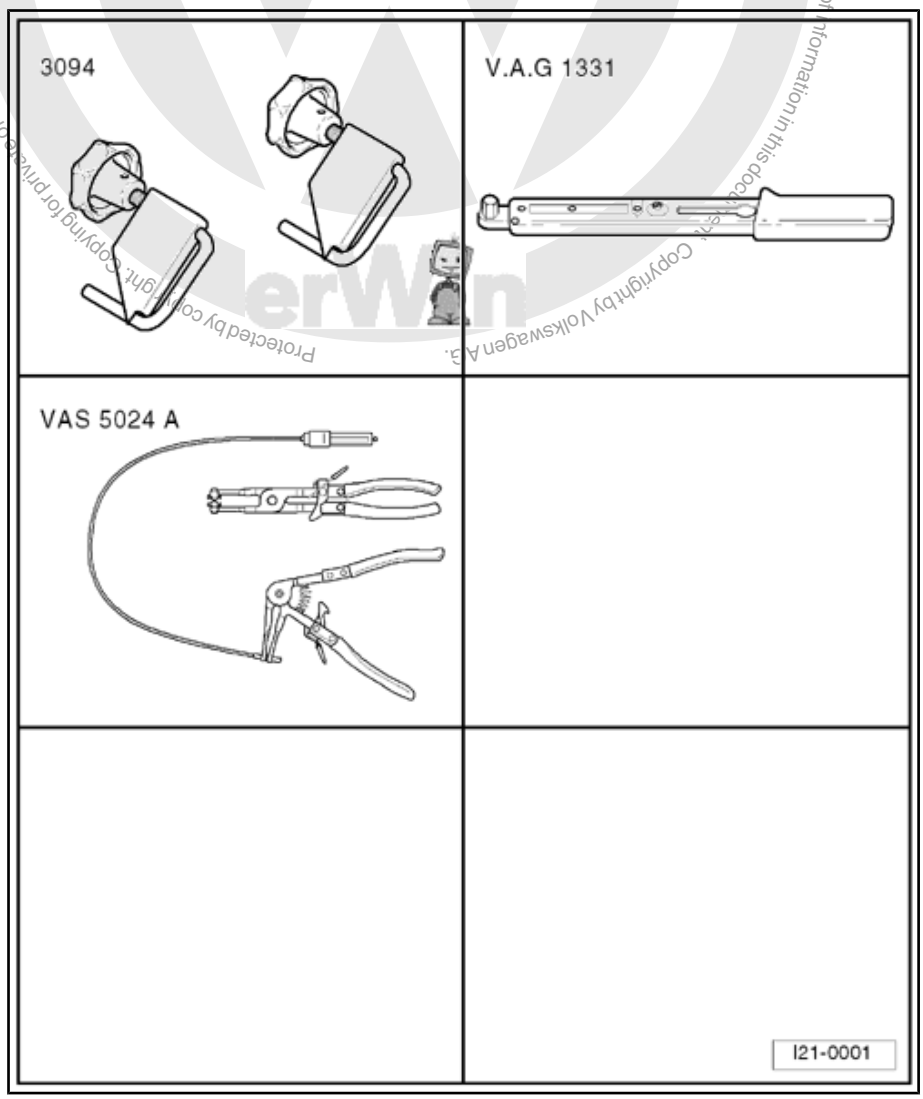
2.3.1 Removing and installing exhaust gas recirculation cooler, engine codes BKC, BXE

Note

- *To improve exhaust emission values the exhaust gas recirculation system has a cooler through which coolant flows.*
- *The engine control unit determines when the recirculated exhaust gas is routed via the cooler. The control unit actuates a vacuum unit via the exhaust gas cooler change-over valve - N345- , which in turn operates the exhaust gas recirculation change-over valve.*

Special tools and workshop equipment required

- Hose clamps to Ø 25 mm -3094-
- Torque wrench - V.A.G 1331-
- Spring-type clip pliers -VAS 5024A-

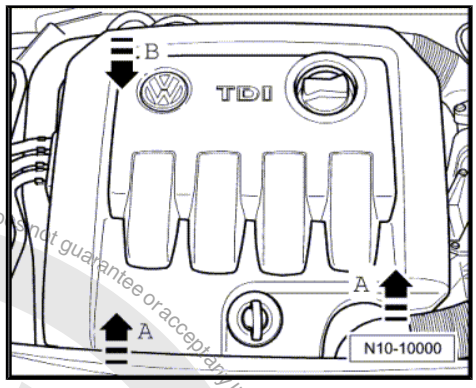


Removing ⇒ page 267

Installing ⇒ page 270

Removing

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

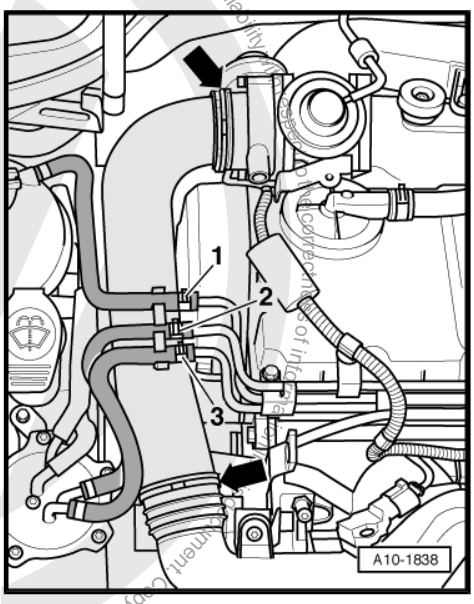


Note

The hoses -1- up to -3- remain connected.

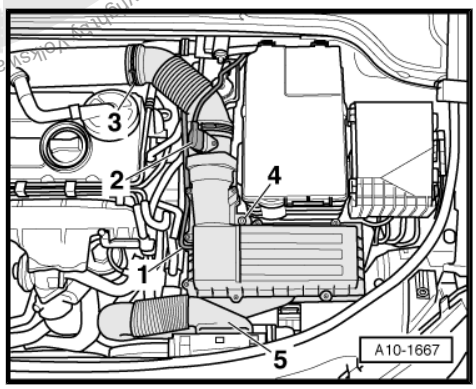
– Place hoses -1- up to -3- on air duct pipe to side.

– Remove air pipe. To do this lift retaining clips -1- lightly.

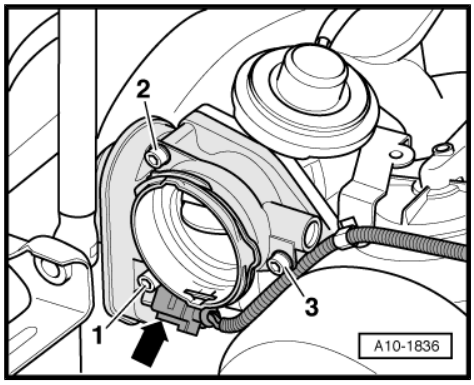


– Disconnect connector -2- on air mass meter -G70- .

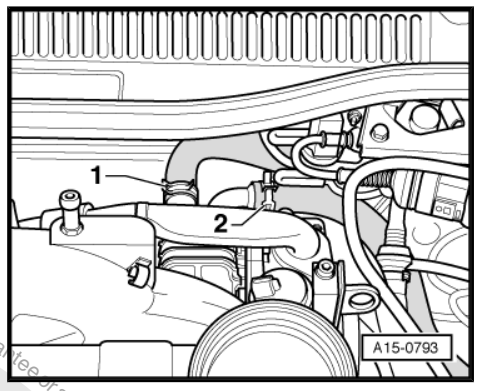
– Pull breather hose -1- and air duct hoses -3- and -5- off.



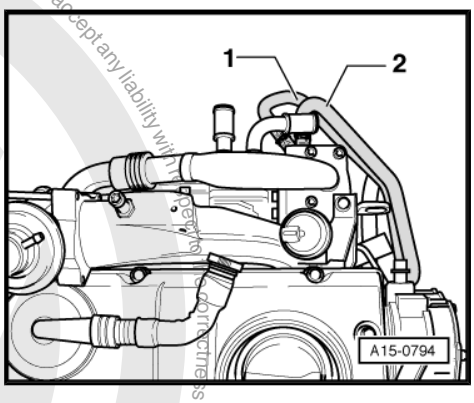
– Disconnect connector -arrow- on intake manifold flap motor - V157- .
– Remove bolts -1- to -3- and take intake manifold flap motor - V157- off.



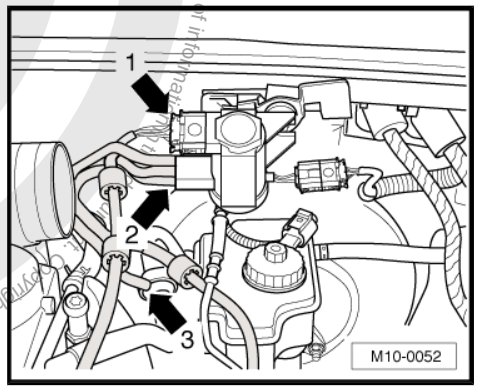
– Pull off or disconnect coolant hoses -1- and -2- on exhaust gas recirculation cooler using hose clamps to Ø 25 mm -3094- .



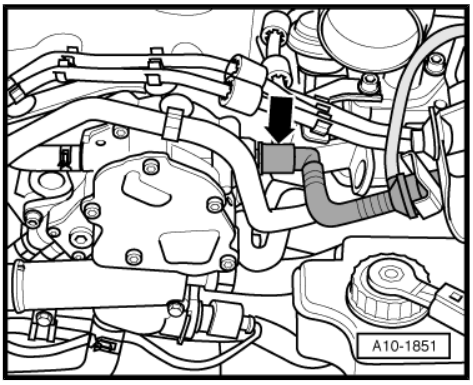
– Pull off or disconnect coolant hoses -1- and -2- using hose clamps to Ø 25 mm -3094- .



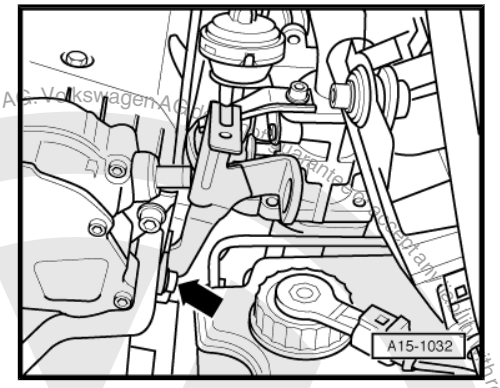
– Pull vacuum hoses -arrow 2- off.
– Pull vacuum hose -arrow 3- off non-return valve for brake servo.



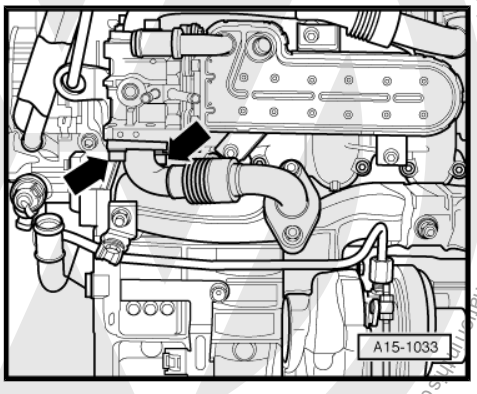
– Pull vacuum hose -arrow- to brake servo off tandem pump.



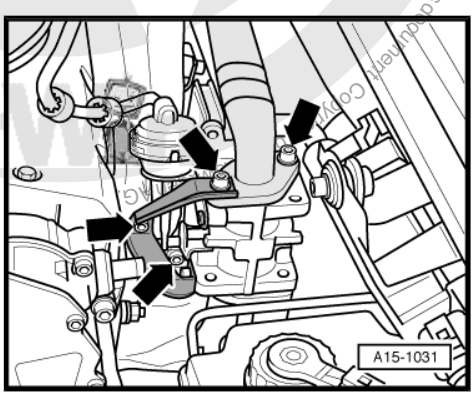
– Remove engine lifting eye on rear of cylinder head -arrow-.



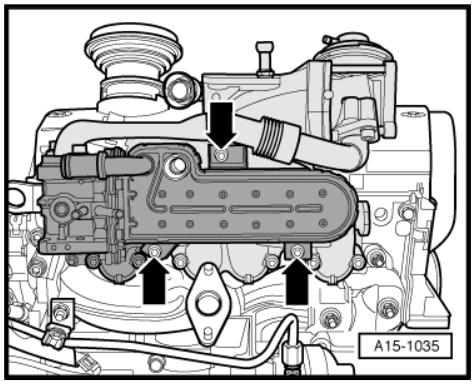
– Remove lower connecting pipe on change-over flap for exhaust gas recirculation -arrows-.



– Unscrew bolts -arrows-.



– Remove exhaust gas recirculation cooler and change-over flap from intake manifold -arrows- and take out.



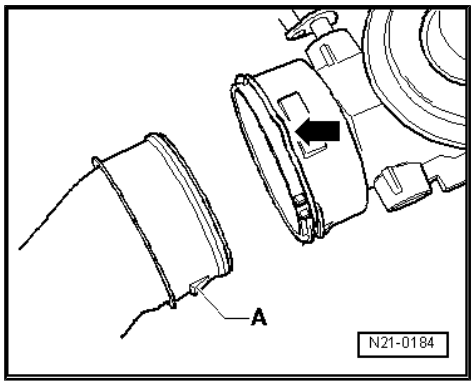
Installing

Install in reverse order. In the process, note the following:

Note

- *Renew gaskets, seals and self-locking nuts.*
- *Observe installation position of seal for intake manifold.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*

– When installing air pipes with plug-in connectors, ensure that the securing clip -arrow- engages audibly on the retaining lug -A-.



– Fill with coolant ⇒ page 127 .

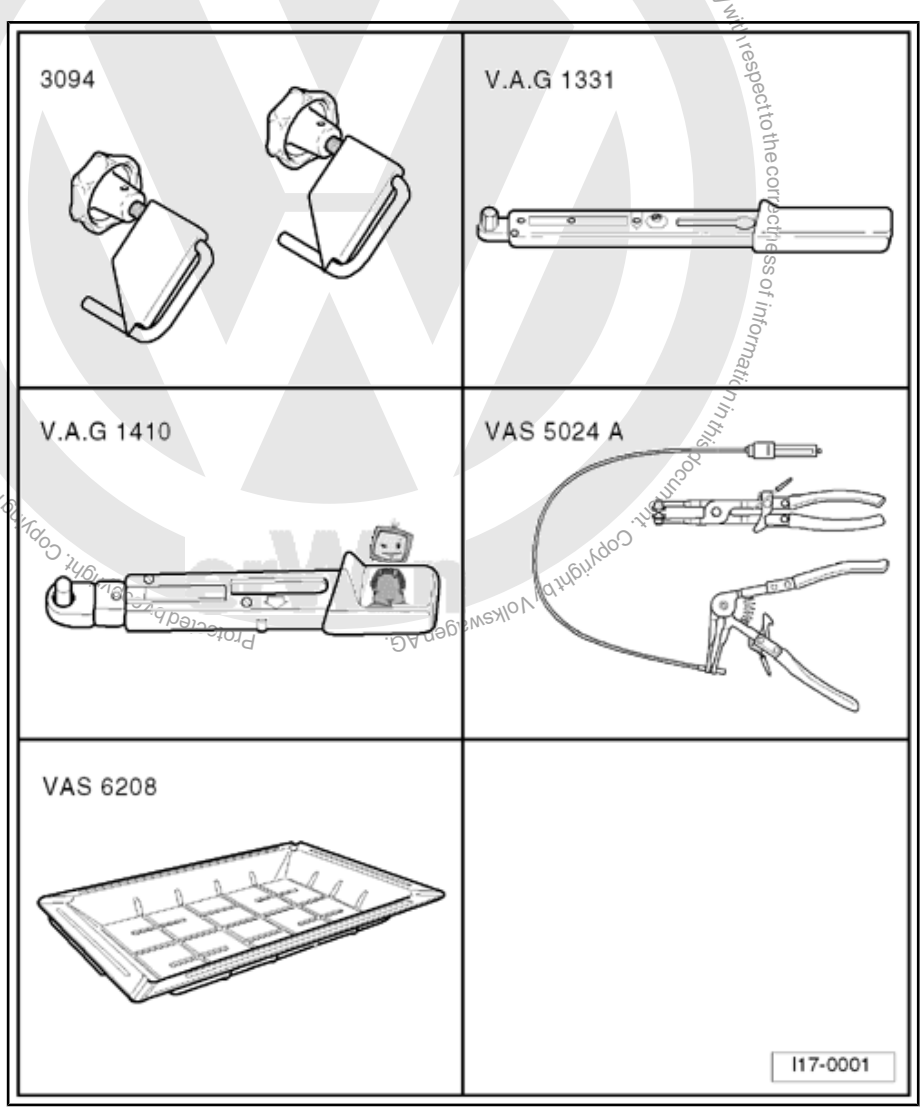
Torque settings

Component	Nm
Exhaust gas recirculation cooler to intake manifold	10
Retainer to intake manifold	10
Connecting pipe for exhaust gas recirculation to change-over flap	22
Intake manifold flap motor - V157- to intake manifold	10
Engine lifting eye on cylinder head	22

2.3.2 Removing and installing exhaust gas recirculation cooler, engine codes BLS, BRM

Special tools and workshop equipment required

- Hose clamps to Ø 25 mm -3094-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1410-
- Spring-type clip pliers -VAS 5024A-
- Drip tray for workshop hoist -VAS 6208 -



Removing ⇒ page 271

Installing ⇒ page 272

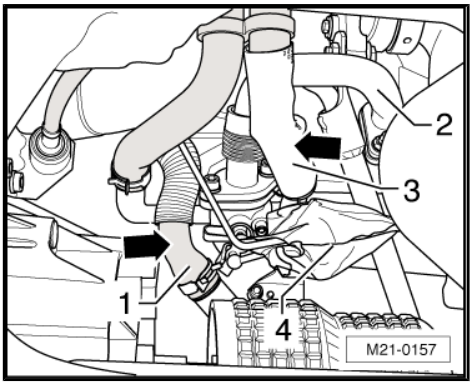
Removing

– Remove front exhaust pipe ⇒ page 248 .

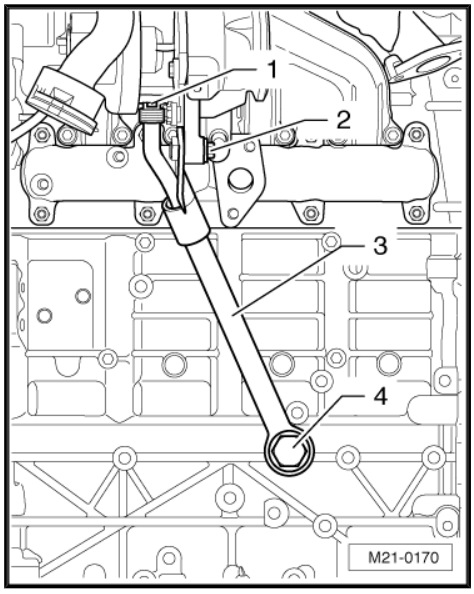
– Disconnect coolant hoses -1- and -3- using hose clamps to Ø 25 mm -3094 - , see -arrows-.

– Open shield -4- and remove.

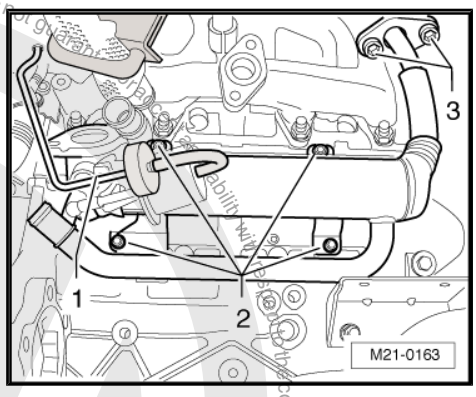
– Remove connecting pipe -2-.



– Remove bolts -1-, -2- and -4- and take oil return line -3- off complete from cylinder block and turbocharger.



– Pull pipe/hose line -1- off.
– Unscrew bolts -2- and -3- and take exhaust gas recirculation cooler off.

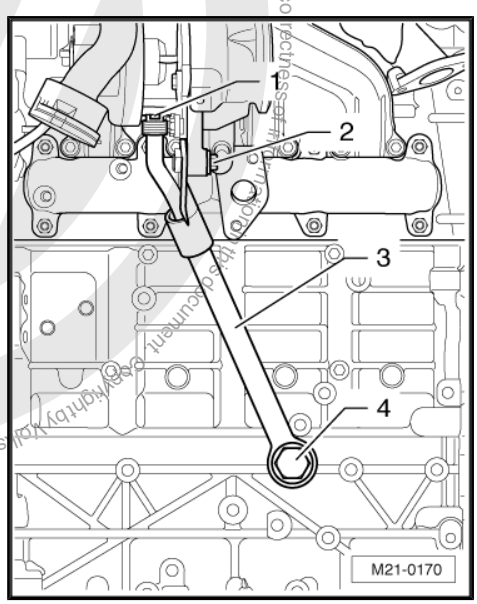


Installing

Install in reverse order. In the process, note the following:

– Install exhaust gas recirculation cooler with new seals.
– Install oil return line -3- complete.
– Renew bolts -4-.

Torque settings ⇒ page 185 .



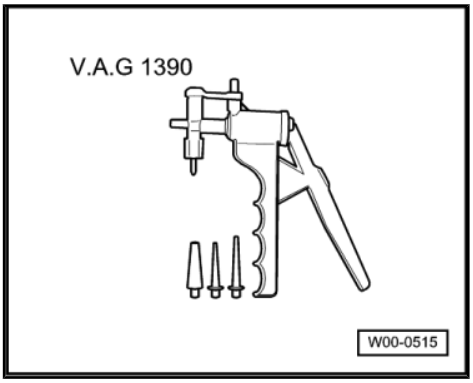
– Install exhaust pipe with catalytic converter ⇒ page 255 .
– Fill coolant system with coolant ⇒ page 127 .
– Check engine oil level ⇒ page 97 .

2.4 Check mechanical exhaust gas recirculation valve, engine codes BKC, BXE

Special tools and workshop equipment required

♦ Diesel extractor -VAS 5226- or

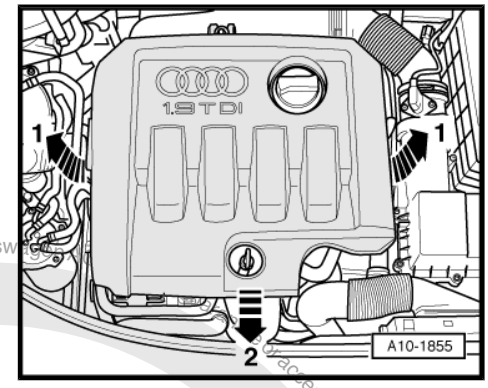
♦ Hand-operated vacuum pump with accessories -V.A.G 1390 -



Test procedure

- Final control diagnosis performed.

– Lift engine cover sideways -arrows 1- and pull off forwards -arrow 2-.



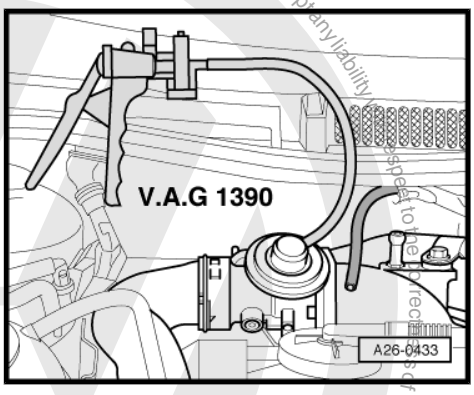
– Detach vacuum hose at mechanical exhaust gas recirculation valve.

– Connect diesel extractor -VAS 5226 - or hand-operated vacuum pump -V.A.G 1390- to the valve.

– Produce vacuum with the diesel extractor -VAS 5226- or the hand-operated vacuum pump.

– Pull diesel extractor -VAS 5226- or hand-operated vacuum pump hose off exhaust gas recirculation valve.

- The closing of the valve should be clearly audible. The membrane rod moves in direction of intake manifold



28 – Glow plug system

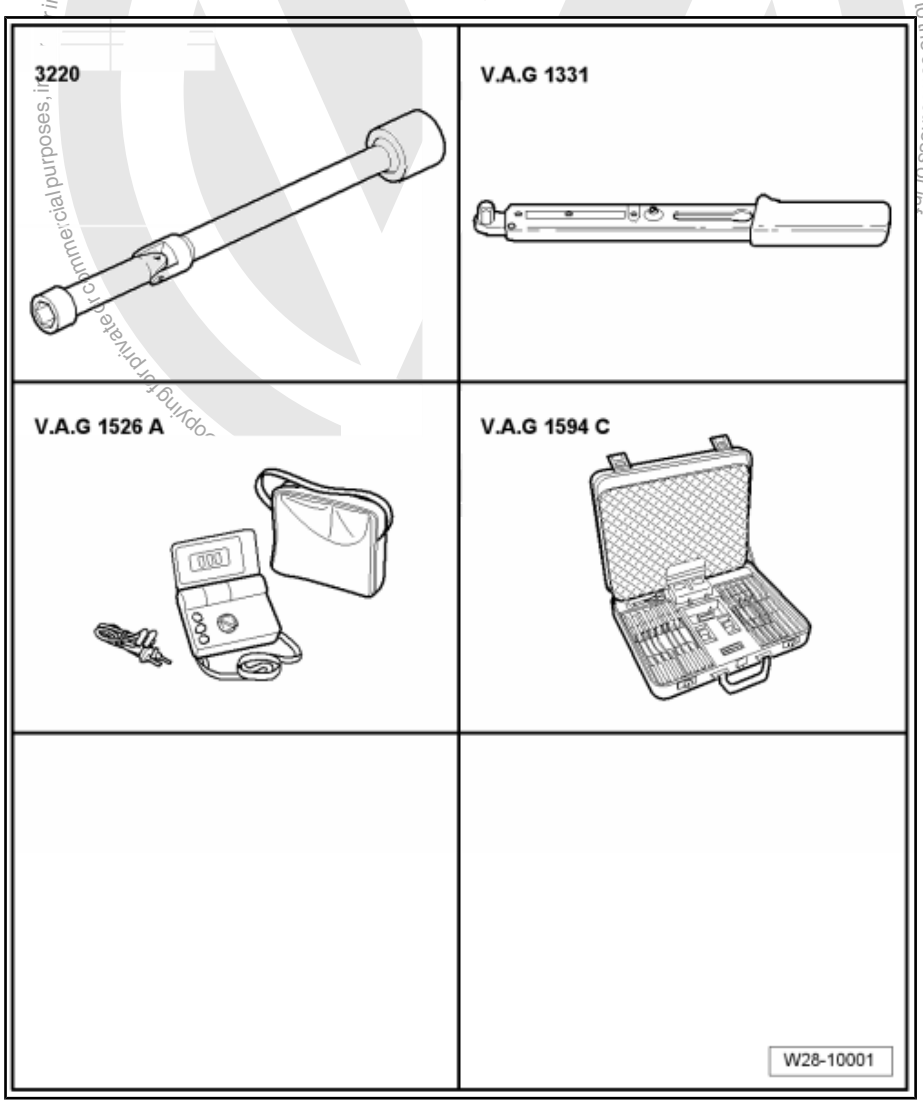
1 Checking glow plug system

Checking, removing and installing glow plugs ⇒ page 274

1.1 Checking, removing and installing glow plugs

Special tools and workshop equipment required

- U/J extension and socket, 10 mm -3220-
- Torque wrench -V.A.G 1331-
- Hand multimeter -V.A.G 1526 C- or hand multimeter -V.A.G 1526 A-
- Auxiliary measuring set -V.A.G 1594 C-



WARNING

- *Ceramic glow plugs* *⇒ page 275* *are sensitive against bumps and bend.*
- *For this reason dropped down glow plugs must never be used, even if no damage can be seen obviously (and even if the height was about 2 cm).*
- *It is absolutely necessary to follow the installation instructions, otherwise there is risk of a pin crack which may result in an engine damage.*

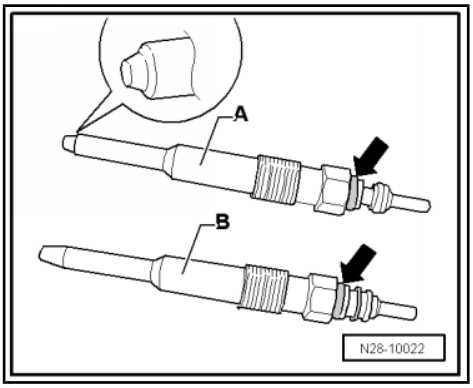
Optical characteristics of ceramic glow plugs

A - Ceramic glow plug

Step at the point (see magnifying glass)
Color code -arrow-: white

B - Metal glow plug

Color code -arrow-: green



Removing and installing ceramic glow plug, check ⇒ page 275 .

Removing and installing metal glow plugs, check ⇒ page 275 .

1.1.1 Removing and installing metal glow plugs, checking

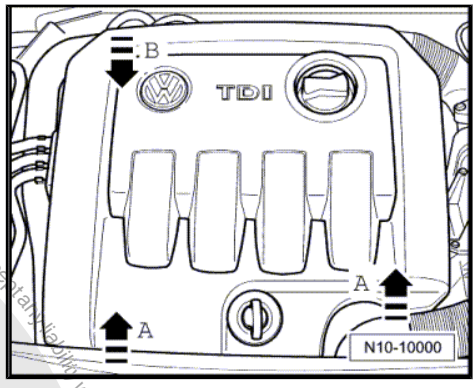
Test requirements

- Fuse box/battery glow plug strip fuse OK
- Battery charge at least 11.5 V
- Ignition switched off

Test procedure

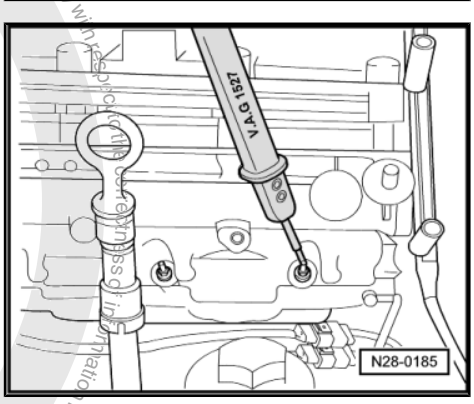
– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Detach glow plug connectors from glow plugs.



– Connect cable of voltage tester -V.A.G 1527 B- with clamps from adapter set -V.A.G 1594 C- to battery positive (+).

– Place test probe of voltage tester -V.A.G 1527 B- on each glow plug one after the other. Diode lights up: glow plug OK., diode does not light up: renew glow plug.



Removing

– Remove glow plugs with jointed spanner -3220- .

Installing

The rest of the assembly is basically a reverse of the dismantling sequence.

– Install glow plugs with jointed wrench -3220- and tighten to 15 Nm.

1.1.2 Removing and installing ceramic glow plugs, checking

Test prerequisites

- Engine is cold
- Ignition switched off

Removing

WARNING

- *Ceramic glow plugs ⇒ page 275 are sensitive to bumps and bending.*
- *For this reason dropped down glow plugs must never be used, even if no damage can be seen obviously (and even if the height was about 2 cm).*
- *It is absolutely necessary to follow the installation instructions, otherwise there is risk of a pin crack which may result in an engine damage.*

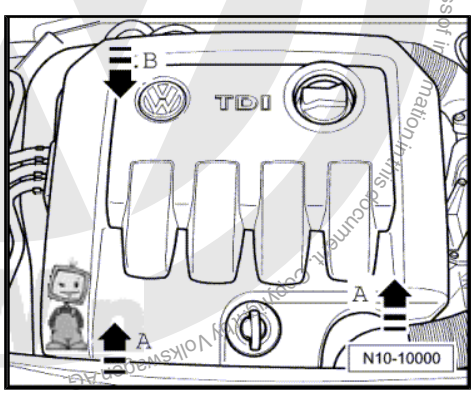
Note

Do not tilt when removing and installing ceramic glow plugs. Remove components hindering the installation.

– Remove engine cover. To do this, pull engine cover upwards abruptly at front -arrows A- and then pull forwards out of rear fastening -arrow B-.

– Detach glow plug connectors from glow plugs.

– Remove ceramic glow plugs with jointed spanner -3220- .



Installing

Install in reverse order. In the process, note the following:

– Before installing, all deposits must be removed completely from cylinder head bore and thread.

Note

The thread of the hole in the cylinder head or the ceramic glow plugs must never be greased or oiled.

– Fit the ceramic glow plugs into the cylinder head by hand using the jointed wrench -3220- .

– Install glow plugs with jointed wrench -3220- and tighten to 15 Nm.

WARNING

- *After installing and before the first engine start on the cold engine, always check resistance of all ceramic glow plugs.*
- *If a defective ceramic glow plug is broken remove all fragments from the engine, otherwise these can cause damage to the engine.*

♦ Specification: max. 1 Ω

– If the specification is exceeded, renew defective ceramic glow plugs.